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A
DICTIONARY

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OF

Practical Surgery :

COMPREHENDING

ALL THE MOST INTERESTING IMPROVEMENTS, FROM THE EARLIEST
TIMES DOWN TO THE PRESENT PERIOD ;

AN ACCOUNT OF THE INSTRUMENTS, REMEDIES, AND APPLICATIONS
EMPLOYED IN SURGERY ;

THE ETYMOLOGY AND SIGNIFICATION OF THE PRINCIPAL TERMS ;

AND

Numerous References to Ancient and Modern Works, forming together a "Catalogue
Raisonné" of Surgical Literature :

WITH

A VARIETY OF ORIGINAL FACTS AND OBSERVATIONS.

BY SAMUEL COOPER,

FORMERLY SURGEON TO THE FORCES ; MEMBER OF THE ROYAL COLLEGE OF SURGEONS ;
OF THE MEDICAL AND CHIRURGICAL SOCIETY OF LONDON ; AND
OF THE MEDICAL SOCIETY OF MARSEILLES.

WITH

NOTES AND AN APPENDIX,

BY WILLIAM ANDERSON,

OF THE COLLEGE OF SURGEONS OF EDINBURGH ; PROFESSOR OF ANATOMY AND
PHYSIOLOGY TO THE VERMONT ACADEMY OF MEDICINE ; AND
LECTURER ON SURGICAL ANATOMY IN NEW-YORK.

IN TWO VOLUMES.

VOL. I.

FROM THE FOURTH LONDON EDITION.

NEW-YORK :

PUBLISHED BY COLLINS & HANNAY, 230 PEARL-STREET.

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1823.



Southern District of New-York, ss.

BE IT REMEMBERED, That on the second day of December, in the forty-seventh year of the Independence of the United States of America, COLLINS & HANNAY, of the said District, have deposited in this office the title of a book, the right whereof they claim as proprietors, in the words following, to wit :

"A Dictionary of Practical Surgery : comprehending all the most Interesting Improvements, from the earliest times down to the present period ; an Account of the Instruments, Remedies, and Applications employed in Surgery ; the Etymology and Signification of the Principal Terms, and Numerous References to Ancient and Modern Works, forming together a " Catalogue Raisonnée" of Surgical Literature ; with a Variety of Original Facts and Observations, by Samuel Cooper, formerly Surgeon to the Forces ; Member of the Royal College of Surgeons ; of the Medical and Chirurgical Society of London ; and of the Medical Society of Marseilles. With Notes and an Appendix, by William Anderson, of the College of Surgeons of Edinburgh ; Professor of Anatomy and Physiology to the Vermont Academy of Medicine ; and Lecturer on Surgical Anatomy in New-York."

In conformity to the Act of the Congress of the United States, entitled " An Act for the encouragement of Learning, by securing the copies of Maps, Charts, and Books, to the authors and proprietors of such copies, during the times therein mentioned." And also to an Act, entitled " An Act supplementary to an Act, entitled An Act for the encouragement of Learning, by securing the copies of Maps, Charts, and Books, to the authors and proprietors of such copies during the times therein mentioned, and extending the benefits thereof to the arts of designing, engraving, and etching historical and other prints."

JAMES DILL,
Clerk of the Southern District of New-York.

ADVERTISEMENT

OF

THE AMERICAN EDITOR.



THE high celebrity which this Dictionary has already attained renders encomium unnecessary on the present occasion. As an apology, however, for reprinting the fourth edition in this country, it may be urged, that seven years have nearly elapsed from the last publication of this work in America, the second edition being then issued under the auspices of the late Professor Dorsey of Philadelphia. Since that time much has been done, both in Great Britain and on the continent of Europe, to add to the stock of surgical knowledge; all which Mr. Cooper has carefully recorded; posting to the present period the improvements that have been made in this department of Science. In this labour his wonted candour is eminently conspicuous, and not to the exclusion of those other qualities which have been ranked among the excellencies of his former writings.

It may nevertheless be asked, Why the necessity of an Appendix? In answering this, the Editor will not plead a custom in the country; but allege, that upon a close perusal of this edition, he has discovered, with surprise, an entire omission of some brilliant surgical achievements, that have their origin on this side the Atlantic. These having been long ago before the public, he is unable to explain why their record has escaped the author's eye. The expediency of their having a place in a book of this nature, he offers, therefore, as one excuse for the appearance of the Appendix.

Another motive not less specious, is founded upon the propriety of giving information of some new surgical operations that have been performed in this country with success, but which have occurred so recently, that any notices respecting them could not have reached our author in time to have had them inserted.

And lastly, as there have been lately presented to the public some new ideas relating to the anatomical structure of the parts within the pelvis, which are supposed will influence the method of operating in lithotomy; the Editor ventures to place them in an appendix, by way of making more known what he considers of the highest importance in this department of operative surgery.

To further these designs, he has taken occasion to extend the article

ANASTOMOSIS—That he might exhibit what he believes to be the only instance on record, wherein opportunity was afforded, of examining into the circulation by anastomosis on the side of the neck and face, after the carotid artery had been tied in the human subject.

ANEURISM—This has been also enlarged to detail the operation by Professor Mott on the arteria innominata in 1818, performed for the purpose of interrupting the blood in its course to an aneurism of the subclavian artery. Under this head also the Editor has proposed a manner of operating for securing the common and internal iliacs, which is easy of accomplishment, and does not endanger the peritoneum, nor give so great opportunity for hernial protrusions as the methods which have been heretofore practised.

AORTA—Under this head the Editor has in view to submit a method of securing the aorta by ligature, without wounding the peritoneum, and with the least disturbance of that membrane.

HYDROPHOBIA—This article has been extended to give place to a paper, read Oct. 1821, by Dr. Michael Marochetti, to the Medico-Physical Society of Moscow, "Upon the hydrophobic virus, and the means of discovering its presence, and destroying its activity on an infected subject." Although we have not yet had an opportunity in this country to test the doctrine, we give it a place on account of the respectable source whence the information has emanated.

LITHOTOMY—What is found in the Appendix relating to this subject is intended to fix the surgeon's attention to the line for the incision through the prostate and neck of the bladder, in this operation.

OSTEO-SARCOMA—Under this head is detailed three cases of operation upon the lower jaw by Professor Mott, of this city, for the removal of this disease. In two of these nearly one half of the bone was successfully taken away. In the third case, the bone was taken from the socket on the one side, and cut through just before the masseter muscle on the other; and although the patient survived but until the evening of the fourth day, yet the circumstances were found to be such upon dissection, which forbid accounting for his death from the operation. These cases evince the high surgical talent of the operator. They must remain on record, and become lasting memorials to the honour of American surgery.

In addition to these, several other articles have been enlarged upon in the Appendix.

38 Beekman-Street, }
New York, 1822. }

PREFACE

TO THE FOURTH LONDON EDITION.

THE flattering reception with which this work has been honoured ; its extensive circulation, not only in this country, but abroad, and in the colonies ; the influence, which it may therefore be presumed to have over the judgment and practice of some thousands of surgeons in different parts of the world ; and the quantity of good, or harm, which it may thus be the means of doing to society ; are reflections, which would not suffer its author to hesitate a moment about conscientiously doing every thing in his power for its completion and improvement. And, were not writers frequently the worst judges of their own productions, his ambition would lead him to hope, that he has not laboured in vain, and that at all events, if he has not been able to make the book in every respect complete and satisfactory, he has succeeded in bringing together a mass of valuable information, constituting a nearer approach to a full and correct history of the Theory and Practice of Surgery, than any other previous undertaking. Throughout the book, he has avoided a blind deference to great names, knowing that experience is the only infallible authority, and, upon every proposal, whether made in ancient or modern times, he has delivered his own sentiments with the same freedom and impartiality, which he would always court for opinions professed by himself. One thing is certain ; viz. that, as he is unconscious of personal dislike to any man in the profession, if he occasionally differs from his brethren wrongly, he may be accused of ignorance, or want of judgment, but never of envy, or private animosity. His steady wish has been to offer an exposition of surgery, where right and wrong doctrines, and good and bad methods, are so contrasted, that the impression in favour of what seems best for the relief of the patient, and the credit of the surgeon, may be rendered as plain and striking as possible. And, upon all controverted and doubtful points, he has uniformly endeavoured to let cases and facts weigh more, than any speculative considerations.

To numerous friends and correspondents, who did the author the honour to notify to him various suggestions for the improvement of the work, he returns his grateful acknowledgments ; and, wherever it has been possible for him to avail himself of these welcome intimations, the opportunity has not been neglected, and the credit of them given to the gentlemen from whom they were derived.

Some of the following cases, proposals, and references, have been inadvertently omitted ; but others unavoidably, in consequence of the articles, to which they relate, having been printed at too early a period for the necessary insertions to be made in them.

AMPUTATION—*Case of Amputation at the Hip-Joint, for the Removal of an Osteosarcomatous Tumour, by R. Carmichael. Vid. Trans. of the Fellows, &c. of the King's and Queen's College of Physicians, Ireland, Vol. 3,*

3vo. Dublin, 1820. The patient, a girl nineteen years of age. The operation was followed by her death on the fifth day.

ANEURISM—*R. Carmichael, Observations on Varix and Venous Inflammation, with Instructions for operating with safety to the Femoral Vein in Popliteal Aneurism.* See *Trans. of the Fellows, &c. of the King's and Queen's College of Physicians, Ireland, Vol. 2, p. 357, &c.* "The only part of the thigh, from Poupart's ligament to the tendon of the triceps, in which the femoral vein is not completely covered by the artery, lies within the space which extends from Poupart's ligament to where the artery meets the sartorius muscle. At the part of this space, most distinct from Poupart's ligament, the vein begins to disclose itself at the pubal side of the artery, from beneath which it emerges more and more as it ascends." Mr. Carmichael's plan is to introduce the needle on the pubal side of the artery, where the vein presents itself to view, and can be most easily avoided.

ANUS, ABSCESES OF—*T. Ribes, Recherches sur la Situation de l'Orifice Interne de la Fistula de l'Anus, et sur les parties dans l'épaisseur desquelles ces ulcères ont leur siège.* See *The Quarterly Journal of Foreign Medicine and Surgery, No. 8, Oct. 1820.* In fistula in ano, the internal orifice, when there is one, is stated to be always within five or six lines above the point, at which the lining of the gut, and the skin conjoin, and generally capable of being seen, when the patient gently strains. This is an important observation, if correct. The advice of M. Ribes never to cut a fistula, unless the inner orifice can be found, is quite repugnant to the doctrines of Mr. Pott, with whom the author of this Dictionary is still disposed to concur.

ANUS, ARTIFICIAL—Cured by Mr. G. F. Collier, on the Taliacotian principles. See *Med. and Physical Journ. for June, 1820.* In this case, the feces used to escape chiefly when the patient was costive.

BRONCHOCELE—The Memoirs of Dr. Coindet on iodine, should have been mentioned in the references. The earliest of these interesting papers was read to the Helvetian Physical Society, July 25, 1820.

BURSÆ MUCOSÆ—Some interesting pathological and practical remarks on inflammation of bursæ mucosæ are contained in *Brodie's Obs. on Diseases of the Joints, p. 305, &c. 8vo. Lond. 1818.*

GRANULATIONS—*Sir Everard Home in Philosophical Trans. for 1819.* The discovery, here alluded to, is briefly noticed in the account of the properties and uses of pus, in the article SUPPURATION.

FRACTURES—A new method of treating old fractures, which have lost all tendency to unite, was successfully tried by the late Mr. Henry Cline, and has been recently practised by Sir Astley Cooper. It consists in cutting down to the ends of the fracture, scraping them well with a scalpel, and then rubbing them with a piece of caustic potassa, so as to destroy the parts of the bone indisposed to union, and at the same time excite such changes in the adjacent portions of bone, as will lead to an attempt at reparation, the formation of callus, and a reunion of the living bone after the detachment of the dead fragments. A few weeks ago, the author of this work was present at an operation of this kind, done by his friend Mr. Earle; but as the case is now under treatment, and this gentleman will probably soon favour the public with the particulars himself, it is judged unnecessary to offer here any premature observations on the merits of the practice, of which no just estimate can yet be formed, on account of the very small numbers of trials hitherto made of it. Like other methods, however, it appears not always to have suc-

ceeded ; but, whether it will do so more frequently, than the plans, for which it is substituted, and with less suffering than the seton produces, time and experience must determine.

LITHOTOMY THROUGH THE RECTUM—It appears from a recent statement, that altogether 15 patients have been operated upon in this way, and that only one case terminated fatally, ten being completely cured, and four quite well, with the exception of trivial urinary fistulæ. See *Journ. Complém. du Dict. des Sciences Méd.* T. 10, p. 180, 8vo. Paris, 1821.

VENEREAL DISEASE—Recent investigations into this difficult subject tend to confirm an observation, made by Fallopius, Palmarius, and other writers of former times, that when mercury is not administered, the bones are seldom affected with nodes, or caries. However, it is not to be supposed, that the non-mercurial treatment is never followed by swellings of the bone, or periosteum. In Mr. Abernethy's Works, Vol. I. or in Vol. II. of this Dictionary, a case is recorded, where a young medical student, in consequence of the infection of a scratch on his finger with the matter of a bubo, had a variety of secondary symptoms, and among them, a thickening of the periosteum on the forehead, and a true corona veneris. The case was treated from the beginning to the end without mercury, and every symptom disappeared. Mr. Abernethy, according to the doctrines formerly in vogue, supposed that the disease could not be syphilis, because the recovery was effected without the reputed specific ; but as this criterion is now proved to be erroneous, the above case would be set down as venereal by the generality of modern surgeons. A day or two ago, Mr. M'Gregor, senior surgeon to the Lock Hospital, mentioned to the author two decided examples of nodes in patients, who had never used any mercury from the commencement of their cases ; but who were obliged to have recourse to this medicine for the cure of these and other secondary complaints. In Mr. Abernethy's case, it has been stated, that the corona veneris, as well as the other symptoms, yielded without mercury. Mr. M'Gregor inclines to the opinion, that syphilis is capable of a spontaneous cure only where the constitution is good ; yet, as the army reports include some thousands of cases, taken promiscuously and cured without the specific, there is some difficulty in explaining the invincible resistance of a few cases to the non-mercurial practice by any supposition of badness of constitution, in the general sense of the expression ; and it must be presumed, that, where many thousands of individuals are treated promiscuously without mercury, and ultimately recover, their constitutions could not all have been healthy. Mr. M'Gregor, however, may be correct, inasmuch as some uncommon peculiarity of constitution may sometimes present itself, in which the use of mercury is *absolutely* necessary for the removal of syphilitic complaints. As far as the experience of the author of this work goes, the frequency of nodes and caries has been considerably lessened since moderate courses of mercury have been substituted for violent salivations ; an opinion, in which he is happy to find himself joined by his friend, Mr. M'Gregor.

A

DICTIONARY

OF

PRACTICAL SURGERY.

This mark () will signify, that the Word which it precedes is further spoken of in the Appendix.*

ABD

A BAPTISTON, or **ABAPTISTA** (from *α*, priv. and *βάπτω*, *immergo*, to sink under.) Galen, Fabricius ab Aquapendente, and especially Scultetus, in his *Armamentarium Chirurgicum*, so denominate the crown of the trepan, because this part of the instrument formerly had a conical shape, which kept it from penetrating the cranium too rapidly, so as to plunge the teeth in the dura mater and brain. It would be quite superfluous here to inquire, whether there was any ground for this apprehension in the ruder periods of the surgical art, when the skilful management of the trepan might not be so well understood as at the present day. While it is admitted by modern surgeons, that mischief may be done by letting the saw penetrate too deeply, they do not find it necessary or adviseable, to obviate the possibility of such an accident, by using a conical trepan, with which it would be difficult to make any perforation at all; but guard against the danger by observing particular rules and cautions laid down in another part of this book. (See *Trephine*.)

It is remarked by Mr. S. Sharpe, that the great labour of working so slowly and difficultly (with a conical saw) is not only very inconvenient to an operator, but by no means serviceable to the operation; for, notwithstanding the saw be cylindrical, and works without any other impediment than what lies before the teeth, yet, even with this advantage, the operation goes on so gradually, that, in all his experience, he never found the least danger of suddenly passing through to the brain, when care was taken not to lean too hard on the instrument at the period of the bone being almost sawn through. (*Operations of Surgery*, p. 151, Ed. 3; also *l'Encyclopédie Méthodique*, *Partie Chir. art. Abaptiston*.)

***ABDOMEN**. **THE BELLY**. The term is said to be derived from the Latin verb *abdo*, to hide, because many of the chief viscera of the body are here concealed.

When a surgeon speaks of the cavity of the abdomen, he confines his meaning to the space, which is included within the bag of the peritoneum. Hence, neither the

ABD

kidneys, nor the pelvic viscera, are, strictly speaking, parts of the abdomen.

Anatomists have distinguished this large cavity into different regions, the terms allotted to which are so very frequent in the language of surgical books, that some account of them in this Dictionary seems indispensable.

The middle of the upper part of the abdomen, from the ensiform cartilage as low down as a line drawn directly across the greatest convexity of the cartilages of the ribs, is called the *epigastric region*.

The spaces at the sides of the epigastric region are termed, the *right and left hypochondria*, or *hypochondriac regions*.

The *umbilical region* extends from the navel upwards to the line, forming the lower boundary of the epigastric region, and downwards to a line drawn across from one anterior superior spinous process of the ilium to the other.

The middle space, below the last line, down the os pubis, is named the *hypogastric region*.

The parts of the abdomen, situated on the outside of the umbilical region to the right and left, or externally with respect to two perpendicular lines drawn from the greatest convexities of the cartilages of the seventh true ribs, are named the *ilia*, or *flanks*. On each side of the hypogastric region is situated the *inguinal region*, or *groin*. The whole of the back part of the abdomen has only one technical appellation, viz. the *lumbar region*, or *loins*.

The abdomen is a part of the body claiming the particular attention of every practical surgeon; for, it is the frequent situation of several of the most important surgical diseases. It is also very much exposed to wounds, and various operations on different parts of it are often indispensable. One of the most common afflictions, to which mankind are subject, is that in which some of the bowels protrude, pushing out before them a portion of the peritoneum. This disease is called *hernia*, and ought to be well understood by every practitioner, who, however, can never acquire the necessary

proper to this operation, named *paracentesis*, simple as it may seem, requires more consideration, and attention to anatomy, than surgeons often bestow on the subject. The abdomen is also exceedingly liable to be wounded. See *Hernia, Paracentesis, and Wounds*.

Abdomen, abscesses of the. These may take place either within the cavity of the belly, or at some point of its circumference, and may be either of an acute, or chronic nature. Women are generally considered more liable, than men, to abscesses in and about the abdomen: the abscesses named *lumbar* being elsewhere treated of, are here excluded from consideration. Collections of purulent matter, resembling turbid whey, and containing whitish or yellowish flakes, are not unfrequently formed in the cavity of the peritoneum, as one of the effects of inflammation accompanying puerperal fever. —(Stoll, *Rat. Med.* 4. p. 103; *Lassus, Pathologie, Chir. T. 1, p. 137, Nouvelle Edit. Svo. Paris, 1809.*)

In lying-in women, abscesses frequently form between the abdominal muscles and the peritoneum, especially just above the groin. They are cases, which have been very correctly described by Conradi. Before the integuments project, the diagnosis is often attended with difficulty, and sometimes an obscurity prevails several weeks; for, the patients seem as if affected with slight colic pains, which yield to common treatment, particularly external applications, but soon return. Thus, unless the vicinity of Poupart's ligament be carefully examined, in which situation some very painful point, or a hardness, or elevation can be detected; the abscess may remain concealed until a large prominence, or the extension of the matter down the thigh, lameness, &c. make the nature of the case completely manifest. As the peritoneum, adjoining the abscess, is always thickened by the preceding inflammation, Conradi assures us, that there is no danger of the collection of matter bursting inwards. Some abscesses indeed have been so enormous, that the matter actually pushed the viscera out of their places, yet all this happened without being followed by any inward bursting of the disease. The whole danger depends upon the duration of the complaint, and the extent to which the matter spreads. A timely detection of the nature of the case, the use of emollient applications, and the making of an early opening, generally brings the disease to a speedy and favourable termination. —(See *Arnemann's Magazin für die Wundarzneiwissenschaft, 1 B. p. 175. Svo. Göt. 1797.*)

Chronic tumours of the mesentery, which, in scrophulous children, sometimes slowly terminate in suppuration, and the diseases of the ovary, and other abdominal viscera, bringing on the formation of matter, are often the cause of purulent extravasation,

great emaciation, hectic symptoms, and death. However, sometimes salutary adhesions are produced between the viscera, by which means an outlet is obtained for the matter through the bladder, anus, or vagina. Thus (says Lassus) in the case of a woman who had had for a long while pains in the right lumbar region, which were supposed to proceed from suppuration of the kidney, because pus was voided with the urine, the right kidney was found after death in the natural state; but an abscess existed in the right ovary, that was adherent to the bladder into which the pus had passed through an ulcerated communication. In another patient, who had voided pus by the anus, the right kidney was suppurated, and adhered to the colon, with which it communicated by a preternatural aperture. A woman had for many years a hard considerable tumour in the abdomen: at length the pain, which she suffered from the disease, became intolerable; and just at the moment when her death was apprehended, an immense quantity of pus was suddenly discharged from the vagina. The pain abated; the swelling of the belly subsided; merely the remains of the obduration were now perceptible; and the woman's health became perfectly re-established. (*Lassus, Pathologie, Chir. T. 1, p. 138.*)

The abscesses, which sometimes form between the peritoneum and abdominal muscles, or between the layers of these muscles, or under the integuments of the abdomen, are attended with considerable variety, according as they happen to be chronic, or acute; circumscribed, or diffused; small, or extensive. Those of the acute or phlegmonous kind sometimes follow stabs and contusions, and are particularly noticed in the article *Wounds*. These are cases, which demand especial care, because, if not checked and kept within certain limits, they may prove fatal, many examples of which are upon record. (See *Commerc. Literar. Noric. 1741, P. 100; Eller, Medic. and Chir. Anmerkungen, P. 108, &c.*) As for chronic external abscesses of the abdomen, they should be opened early, and treated on the principles explained in the article *Lumbar Abscess*.

For further information, respecting abscesses of the parietes of the abdomen, the reader may consult *Commerc. Literar. Noric. 1735, hebd. 37; C. Bell, System of Dissections, Tab. 1. Bourienne, in Journ. de Médecine, T. 43, P. 64; Collomb. Med. Chir. Werke, Obs. 28; J. H. Furstenaui, Diss. Abscessuum musculorum abdominis, &c. læta tristiaque exempla, Rintel, 1742; Hoffmann, de Fœre Tertiana, Obs. 7. vid. Op. 2. P. 20; Heuermann, Vermischte Bemerkungen, 2. &c. Kite, in Medical communications, 2. No. 6, and app. to Essays on submer-sion, &c.; Riverus, Obs. Communicat. Obs. 2. 3; Winship, in Memoirs of the Medical Society of London, 2. No. 52; Wrede, Collectanea Chir. T. 1.*

Hard indigestible substances, after being swallowed, are not unfrequently dis-

charged from abscesses formed in some of the abdominal regions. (See *De La Grange, in Museum der Heilkunde, 4. B. P. 154: a fishbone, which had been swallowed, found in the abscess; Petit, Traité des Mal. Chir. T. 2, p. 226: aul, without a handle, extracted from an abscess of the abdomen; and many other analogous cases*.)

Encysted tumours sometimes form between the peritoneum and abdominal muscles, and attain an immense size, before they burst; a remarkable specimen of which is detailed by Gooch. (*Chirurgical Works, Vol. 2. p. 144. &c. 8vo. Lond. 1792.*) In this case, the spontaneous opening of the navel was enlarged with caustic, and the cyst extracted; but, before a cure could be effected, it became necessary to make a depending opening, and introduce a seton. Swellings of this nature, however, are only noticed here, on account of their resemblance to circumscribed chronic abscesses of the parietes of the abdomen.

Abdomen, Pulsations in the. From the article *Aneurism*, the reader will understand, that, though it be the common nature of this disease to be attended with throbbing, it is not every pulsating tumour, which is an aneurism. The cases, usually called *abdominal or epigastric pulsations*, often furnish a proof of the correctness of the preceding remark. The authors, who have treated of the latter affection with the greatest discrimination, are Dr. Albers, of Bremen, and Mr. Allan Burns, of Glasgow. Some of the pulsations here referred to are a consequence of organic disease, capable of demonstration on dissection; while the rest are not attended with any such appearance, and have therefore been regarded as nervous. The pulsation is not always produced by the impulse communicated to some solid tumour, or substance between the hand and the artery, but is sometimes certainly dependent on a nervous affection of the vessel itself. (*On Diseases of the Heart, p. 263.*) Hippocrates, in his book "*De Morbis Popularibus*," makes mention of three patients, affected with extraordinary pulsations in the abdomen. As one of these cases originated from obstructed menses, it was probably not the result of any organic disease. (*Hippocratis Opera Omnia, ex edit. Fesii. Francof. 1621. lib. 5. sect. 7. p. 1144.*) In order to remove a difficulty, which may be at first experienced in believing how an artery, not affected with aneurismal enlargement, can communicate to the parts which lie over it such movements as are frequently remarked in cases of abdominal pulsations, a fact pointed out by Mr. Hunter, should be remembered: in speaking of the actual dilatation of an artery, he says, that when the vessel is "covered by the integuments, the apparent effect is much greater than it really is in the artery itself; for, in laying such an artery bare, the nearer we come to it, the less visible is its pulsation; and when laid bare, its motion is hardly to be either felt or seen." (*Treatise on the Blood, &c. p. 175. 4to. Lond. 1794.*)

And this observation will apply to all tumours and indurations situated over a large artery. In the epigastric region of a certain patient, Taberranus felt not only a pulsation, but a tumour as large as the fist, with all the other usual symptoms of an aneurism. On opening the body after death, he was therefore surprised to find, instead of this disease, a considerable scirrhus tumour in the middle of the mesentery, so closely connected to the large vessels, as to compress the aorta, by the pulsations of which it had been lifted up. (*Obs. Anat. ed. 2. No. 9.*)

Dr. Albers quotes an extraordinary case from Tulpus: the patient, a laborious man, but subject to bilious attacks, was sometimes affected with violent throbbings of the spleen. These pulsations were not only very painful, but could be heard at a distance, and their number distinctly counted, when the hand was applied to the part. What seems almost incredible, it is alleged, that Tulpus could hear them at the distance of thirty feet! Their violence increased, or diminished, according as the patient was more or less bilious, and sometimes they entirely ceased, when his health improved; but always recurred, as soon as the chylopoietic organs got out of order again. After the patient's death, permission could not be obtained to open the body. (*Tulpii Observationes Medicæ. Amst. 1652. lib. 2. cap. 28.*)

The case of a female, recorded by Pechlin, is then adduced, which consisted of a complication of symptoms, amongst which the only one, claiming attention here, was an annoying throbbing in the abdomen. The pulsation, which was quite evident, was felt by Pechlin when he placed his hand upon the linea alba, and corresponded to the pulse at the wrist. The patient fancied, that a monster was in her abdomen; but Pechlin comforted her with the assurance, that the throbbing was only the motion of the large artery, rendered perceptible by her extreme emaciation. She lived three years with this disease, suffering at times severely from convulsions, of which she at last died. Pechlin was informed, that before her death, her body was shortened two feet, the ribs being bent down to the ossa pubis, and the whole vertebral column curved forwards. (*Pechlini Observationum Physico-Medicarum, libri tres. Hamburgi, 1691, lib. 2, Obs. 6.*)

According to Bonetus, pulsations in the left hypochondrium are not unfrequent, and it was his belief that they were produced by the celiac artery. He cites several cases of this disorder from other writers, the tenor of which is to prove, that the celiac artery and mesenteric vessels must have been affected, as they were found after death dilated and filled with black blood. (*Sepulchretum Anatomicum, lib. 1. sect. 9. Obs. 9, 26, 27, 30, 38, 42, 44, 45, and 46.*) The conjecture of Bonetus and others, however, respecting the frequency of abdominal pulsations from dilatation of the celiac and mesenteric arteries, by no means coincides with the results of modern observa-

tions. Mr. Wilson, whose dissections have been very numerous, says, that he has met with only one instance of true aneurism, affecting any of the branches of the aorta, which are distributed to the abdominal viscera. This case was an aneurism of the left branch of the hepatic artery. (*Lectures on the Blood, and on the Anatomy, Physiology, and Surgical Pathology of the Vascular System, &c.* p. 379. 8vo. Lond. 1819.) Bontius was present at the opening of an inhabitant of Batavia, who had been afflicted three years with a disease, the exact nature of which could never be made out during life. When the hand was applied above, or below the navel, a pulsation was felt like that of the heart, or an artery, and as forcible as the motion of a child in the womb. It was synchronous to the pulsation of the heart and arteries. Hence, Bontius concluded, that the case was owing to some affection of the heart. The vena cava, instead of containing blood, was filled with a medullary substance, which, pressing against the aorta, is supposed to have excited the extraordinary pulsations in that vessel. The heart was unusually dilated, and flabby. The two ventricles were very large, and filled with dark-coloured blood. The liver was of nearly twice the natural size, its substance being of a light colour. The gall-bladder resembled that of a bullock, and was filled with viscid bile nearly as thick as an extract. (*Jacobi Bontii de Medicina Indorum, libri 4. Lugd. 1718. Obs. 8. p. 101.*)

Lewenhoeck met with an instance of a similar pulsation, which he imputed to irregular action of the diaphragm, the pulse at the wrist not being affected. The disorder lasted three days, during which the functions of the alimentary canal were so much interrupted, that the patient was expected to die. (*Philosophical Trans. from 1719 to 1733, abr. by J. Eames, &c. Lond. 1734. vol. 7. p. 683.*)

Ballonius recites the case of a man, affected with a quartan fever, gout, and other complaints, who had so violent a pulsation in the left hypochondrium, that it was supposed to originate from an aneurism. The patient died suddenly (as Ballonius imagined) of a rupture of one of the vessels of the spleen. (*Ballonii Epidemicorum et Ephemeridum, libri 2. Venetis, 1734. Consiliorum Med. Lib. 1. p. 379.*)

Dr. Albers has also described the particulars of a man's case, recorded by Burggraf, and entitled "Diuturna, magna, et valde molesta pulsatio in epigastrio." (*Vid. Acta Natur. Cur. Norimb. 1740, Vol. 6, Obs. 131.*) Burggraf gives his reasons for believing, that, in this instance, the pulsation arose neither from the aorta nor from the celiac artery; and suspects that it was caused by a dilatation of that considerable branch of the inferior mesenteric artery, which inosculates with the branch of the superior mesenteric. This idea, however, which was merely surmise, could not be correct, as the patient was cured by taking in the form of pills, every morning and even-

ing, half a dram of a mass composed of equal parts of Gum Ammoniac, extr. Centaur. Minor, and Venice soap.

Then follows an example taken also from Burggraf. (*Anserlesene Med. Falle und Gutachten, Frankf. Am. M. 1784, S. 300.*) A young man, after experiencing some complaints of the stomach, began to feel pain and tenderness about the scrobiculus cordis. At length a pulsation was detected just below the ensiform cartilage. It was not very considerable when the stomach was empty, but always increased after a meal. In the course of the disease, the patient had various symptoms of dyspepsia, and became so costive, that he had a motion only once in three or four days. Various opinions were given by the physicians concerning the nature of the disease, about which, however, Burggraf finally leaves the reader in the dark.

Dr. Albers details the particulars of another case from the work last quoted. (p. 310.) The patient, a young woman, three and twenty years of age, whose menses had been obstructed five months, became affected with violent throbbings in the epigastric region, which were synchronous to the pulsations of the heart, and so forcible, that they seemed as if they proceeded from a displacement of the latter organ into the upper part of the abdomen. Dr. Massuet of Amsterdam considered the affection altogether as an effect of obstructed menstruation and hysterics, and of course, prescribed medicines calculated to re-establish that evacuation. Some physicians of Leipsic, however, who were probably quite mistaken, looked upon the case as an aneurism either of the arteria gastrica, or gastro-epiploica, and ordered repeated venesection, aperients, and a bandage.

In the valuable essay of Albertinus, on diseases of the heart, as a cause of difficult respiration, there is a passage where he is speaking of the diagnosis of enlargements of the heart, aneurism of the curvature of the aortæ, &c., which Dr. Albers cites, as deserving attention in the present subject. "Verumtamen extra pectus ubi deficiente solido arcu costarum, tantum difficultatis in hac indagine non ostenditur, me satis scio pluries indicavisse ex eo, quod vasis diametrum non auctum perceperim validas, assidueque arteriæ celiacæ, vel aortæ in abdomine pulsationes fuisse sine dilatatione, nec judicium meum eventus fellit." (*De Bononiensi Scientiarum et Artium Instituto, atque Academia Comment. Bononiæ, 1748, T. 1. p. 387.*)

An example follows from the writings of the celebrated Störk. After death, the symptoms were found to have arisen from disease of the pancreas, which weighed thirteen pounds, and contained a large cyst filled with lamellated blood. (*Annus Medicus, Vindob. 1760, p. 245.*)

The subsequent case, somewhat analogous to the former, is from a different author.

A man, aged 60, complained of pain in the left side of the abdomen, midway between the umbilicus and crista of the ilium.

Emaciation, weakness, distress of countenance, anorexia, constipation succeeded. At length, a large pulsating tumour was discovered in the epigastric region. The case was now pronounced aneurism of the abdominal aorta. There was no nausea, nor vomiting, except that some days before death, a quantity of fetid, blackish fluid was twice or thrice voided. No fever. The swelling caused a sense of constriction rather than pain, and the throbbings became more perceptible. The pulse was feeble, but slow and regular. After death, the stomach was found adhering to the liver, pancreas, and abdomen; and a cancerous tumour occupying its internal surface from the duodenum to the insertion of the œsophagus, the coats of the stomach being an inch thick. The surface of the pancreas was also diseased, and the pylorus, situated in the midst of the cancerous mass, was contracted by the thickening of the parietes of the stomach, and obstructed by numerous fungi. The liver was large, but apparently sound; the spleen small. The aorta, the cœliac trunk, and its branches were quite natural. (*See Journ. de Med. per Leroux, Oct. 1815, and Medico-Chir. Journ. Vol. I. p. 289.*)

Morgagni describes the case of a woman, 44 years of age, who, after a suppression of the menses for some months, was attacked with palpitations in the epigastrium. Morgagni, on applying his hand to the part, felt a large hard body moving forcibly. At first, it was regarded as an aneurism in the abdomen; but, as there were no similar throbbings in the chest, and there was nothing extraordinary in the pulse at the wrists, Morgagni concluded, that the movements in question could not depend upon the heart. Neither did he take the disease for an aneurism, because the throbbings did not correspond to the pulse. As for the large indurated mass, it appeared to him more easy to say what it was not, than what it was: it could not be merely a *globus hystericus*, which never beats like an aneurism. Morgagni considered the case as an hysterical spasmodic complaint, ordered the patient to be bled, and the following day the pulsations ceased. (*Morgagni, de Sedibus et Causis Morborum, T. 2, Epist. 39, 18.*)

Aaskow relates a case, in which, after the subsidence of a hard painful swelling under the upper false ribs of the right side, a peculiar throbbing movement presented itself in the same part. The phenomenon was imputed to the diaphragm: "et in loco dolente singularis motus palpitationis instar, evidenter enim conspicietur, quasi musculus diaphragmatis se constringendo partes vicinas comprimeret et extrorsum protruderet." (*Acta Societatis Medicæ Havnienſis. Havnæ, 1777, Vol. 1, p. 208, &c.*)

Senac has spoken of these abdominal pulsations, as sometimes occurring in hypochondriacal and chlorotic patients; and as they frequently subside, without leaving any vestige behind, he sets them down as nervous affections. (*Traité des Mal. du Cœur.*)

De Haen had under his care a hypochon-

driacal patient, affected with pulsations in the abdomen; which, with other complaints, were dispelled by means of brisk opening medicines. (*Heilung's Methode Uebersezt von Plattner, Leipz. 1782. 2. B. S. 29.*)

Thilenius observed a flatulence of the stomach, which he represents as having been epidemic, and attended, in some patients, with pulsations at the scrobiculus cordis. (*Med. Chir. Bemerk. Frankf. 1789. S. 211,—217.*)

My friend, Mr. Hodgson, also, in speaking of pulsations in the epigastrium, which are not the consequence of organic disease, and occur in irritable hypochondriac subjects, states his opinion, that, in some instances, such pulsations were a consequence of distention of the stomach with air, which was thrown against the abdominal muscles by the pulsation of the great blood vessels; and in these cases, the throbbing was diminished by the eructations. (*On the Diseases of Arteries and Veins, p. 96.*)

These abdominal pulsations are also described by Zuliani, as a symptom of hypochondriasis and hysteria. (*De Apoplezia, Lips. 1790, p. 79.*) They also happen in certain febrile diseases. (*Versuch über den Pemphigus und das Blasenſieber von C. G. C. Braune, Leipz. 1795, S. 23; and Dr. R. Jackson on the Fevers of Jamaica, 8vo. Lond. 1791.*)

In a dissertation on cramp in the stomach, Haü remarks. "Quin immo, ubi diutius vexavit gastrodynia, continuos ægotans persentit spasmos, ut et haud raro pulsationem quandam plane singularem, in cardia et ventriculo, pulsui autem cordis minime synchrone." (*Diss. de Gastrodynia, Upsal. 1797.*) In the same essay is also given an account of a man, who had violent palpitations in the epigastric region, apparently first excited by the larva of the musca pendula, many of which were vomited up.

Pinel is another writer who describes these abdominal pulsations, as an occasional symptom of hypochondriasis. "Palpitations du cœur, et quelquefois une sorte de pulsation irrégulière, dans quelque partie de l'abdomen." (*Nosographie Philosophique. T. 2, p. 25, Paris, an. 6.*)

Dr. Albers details some cases which fell under his own notice. A young woman, whose menses were upon her, and who had been for some days constipated, was seized with frequent fainting fits and febrile symptoms, occasionally voiding from the bowels a quantity of dark matter, each evacuation of which was followed by a swoon. One morning at five o'clock Dr. Albers was sent for, as it was feared the patient was about to die. She was extremely exhausted, and the fainting fits followed each other, with hardly any intervals. She could just say, "I feel a throbbing in the belly;" and, when Dr. Albers applied his hand to the part, he felt a violent pulsation, extending from the ensiform cartilage down to about the bifurcation of the aorta. The action of the heart was weaker than natural; the pulse at the wrist very small, but not quicker than it had been on the preceding day, and

was not synchronous to the throbbing in the abdomen. Dr. Albers confesses, that at first he took the case for an aneurism. Dr. Meyerhoff was of the same opinion. Another physician, however, Dr. Weinhold, entertained doubts of the complaint being aneurismal, saying, that he recollected having read some similar cases in Morgagni. These gentlemen decided to persevere in the employment of opening medicines and clysters, combining opium with the former. Under this plan, the pulsations in the abdomen and tightness of the chest diminished in a few days. The stools were at first of the colour of chocolate, but afterwards resumed their natural appearance. The throbbings, in a weakened form, however, were perceptible for six weeks longer. The patient at length got quite well, and was remaining so four years afterwards.

A man, about 40, severely afflicted with hypochondriasis, great oppression of the chest, constipation, and tension of the abdomen, tendency to fainting, &c., complained to Dr. Albers, that he felt as if his heart had fallen down into his belly, where he was annoyed with an incessant throbbing. Indeed when Dr. Albers examined the abdominal parietes, he could feel a very strong pulsation, and, what is curious, could trace it not only along the track of the aorta, but in the course of the left iliac artery. The pulse at the wrist, which was small, frequent, and hard, did not correspond with the abdominal pulsations. For several days, the evacuations from the bowels had been as black as pitch. After the employment of gentle purgatives, all the complaints quickly abated, though the throbbings were feebly perceptible for nine months afterwards.

The next case, which Dr. Albers met with, is very interesting. A robust sailor, whose bowels were so constipated, that hardly the strongest purgative could affect them, was seized with constant pain in the left hypochondrium. With this complaint were soon joined great pain in the back, and a sensation as if something alive moved about in the belly from one side to the other, and thence extended up to the neck, followed by the vomiting of a greenish matter. At the same time, he felt in the left side a pulsation, which he took for that of the heart, and which continued the whole of his illness. The pulse at the wrist was natural, and synchronous with that in the abdomen. In the beginning of the disorder, the patient was obliged to sit with his body very much inclined forward, as no other posture could be endured. For the first week opening medicines afforded so much relief, that he was sometimes quite free from pain for six or eight hours. After a time, a round swelling formed in the left hypochondrium, and reached to the navel, and attained with incredible quickness the size of a child's head. Indeed, it could now be traced beyond the umbilicus to the right side. The motions were quite of a dark colour, or else red blood and a puriform matter was discharged. Sometimes the blood voided was

of a bright red colour, sometimes it was dark, coagulated, and mixed with bile. The patient was at length worn out with febrile symptoms, and died. On opening the body, Dr. Albers found a swelling in the middle of the mesentery, the texture of which cannot be easily described, and the circumference of which was 16 French inches. The stomach was filled with coagulated blood. The spleen, pancreas, and liver were sound; but the gall-bladder was of prodigious size, and contained a very thick viscid bile. The arteria cœliaca, arteria coronaria ventriculi, and the arteria mesenterica, were preternaturally dilated, and full of dark coloured blood. He speaks of them, however, only as being in an enlarged, not an aneurismal state. Dr. Albers thinks it highly probable that it was one of these vessels, by which the pulsations had been occasioned.

Dr. Albers has also seen these abdominal pulsations in a paralytic female; and in a lunatic, who was afterwards seized with apoplexy. He likewise met with a married woman, the mother of several children, in whom these throbbings took place invariably at the commencement of pregnancy, and were a surer sign of this state than other usual effects, as stoppage of the menses, &c. After the third month, however, they used to cease altogether.

Many valuable practical observations on cases attended with hemorrhages from the intestinal canal, my limits here oblige me to pass over. According to Dr. Albers, hemorrhoidal patients, especially when put to inconvenience by compression of the tumours, often complain of throbbings about the spleen, which are plain even to the hand.

The same gentleman says, that he has often remarked these pulsations in hypochondriacal and hysterical patients, who were put to much distress by the occurrence, as they supposed their hearts were out of their right places. (*J. F. Albers, über Pulsationen im Unterleibe*, 8vo. Bremen, 1803.)

The differences pointed out by this able physician, between these pulsations and those of internal aneurism, will be presently noticed.

Dr. Parry makes a few interesting remarks on such abdominal pulsations as excite apprehensions of aneurism. In any persons not very fat and lying upon their backs, he says, the pulse of the aorta can easily be felt, if strong pressure be made a little to the left of the median line, about half way between the navel and scrobiculus cordis. In certain instances, the pulsation is painfully felt by the patient himself. In many cases of this kind, particularly in nervous individuals, the sense of pulsation is merely the effect of preternatural action of the heart. While, in other examples, it is the effect of the pressure of some hard substance upon the descending aorta, determining a disproportionate quantity of blood to the head, "and giving to the hand placed on the abdomen, and sometimes even to

the eye, the appearance of a beating so near the surface, as to lead inexperienced observers to conclude, that the aorta is morbidly dilated." According to Dr. Parry, the most common causes are collections of fœces in the colon, requiring repeated and active purgatives, which must bring away almost incredible discharges of stercoraceous matter before the aortal pulsation subsides. (See *Parry's Elements of Pathology*, &c. and the *Medico-Chir. Journ. and Review*, Vol. 1, p. 157.)

Another cause of a temporary appearance of pulsation or movement in the abdomen, not mentioned by any of the preceding authors, is the power which some persons have of putting portions of the recti muscles separately into strong convulsive action. I have seen a large abscess of the loins, attended with distinct and forcible pulsations, corresponding to those of the aorta.

According to Mr. Allan Burns, a beating is generally felt about the pit of the stomach, in the advanced stage of chronic inflammation of the heart: in this case, when the pericardium is closely adherent to the latter organ, it is corrugated at every contraction of the ventricles, and the diaphragm and liver are elevated. The ventricle, however, having completely emptied itself, is again distended, and, in proportion to the degree of dilatation, the liver and diaphragm descend, whereby an impulse is communicated in the epigastric region. (*On Diseases of the Heart*, p. 263.) This valuable writer cites the remark of Morgagni, (*Epist. 17, art. 28*), that sometimes in dilatation of the heart, this organ descends so far as to push the diaphragm into the hypochondrium, and pulsate in that situation, so that the disease is mistaken for an aneurism of the cœliac artery. In Mr. Burns's work, a memorable case of this description is related. An erroneous judgment is the more likely to be formed in such examples, because the pulsations of the heart and tumour are not exactly simultaneous; for, it is not the heart which is felt directly beating, but the liver, which, by the action of the heart, is thrown forwards. Hence, the palpable interval between the stroke of the heart, and the movement of the liver.

Preternatural pulsation about the epigastrium is also stated by Mr. A. Burns, to be sometimes occasioned by encysted tumours, attached either to the lower surface of the diaphragm, or formed between the layers of the pericardium towards the diaphragm, as happened in an instance recorded by Lancisi.

Another cause specified by Mr. A. Burns, is enlargement of the vena cava, or of the right auricle of the heart. Senac describes a case, in which the vena cava was as large as the arm, and there had been a violent pulsation in the epigastrium.

The next cause, enumerated by the same gentleman, is increased solidity of the lungs, more especially of their lower acute margins, where they overlap the pericardium.

In this case, the pulsation is about the scrobiculus cordis.

Mr. A. Burns likewise comprises several other causes of epigastric or abdominal pulsations, already illustrated in the foregoing part of this article, indurations of the pancreas, scirrhus of the pylorus, tumours in the mesentery, or any solid increase of substance about the abdominal aorta, or its principal branches; and, lastly, it is called a peculiar affection of the vascular system itself.

The following observations, on the criteria between various abdominal pulsations and those of aneurism, appear interesting.

According to Dr. Albers, an internal aneurism originates gradually, and the pulsations increase in strength by degrees. Other abdominal pulsations, on the contrary, begin suddenly, and are more violent in the beginning, abating after they have lasted some time.

In an aneurism, the pulsation is synchronous with the stroke of the artery at the wrist; but this is not regularly the case with other pulsations.

Should the patient be affected with melancholia, hypochondriasis, hysteria, or other nervous complaints, void blood from the stomach, or a black matter from the bowels; should there be any hardness or swelling of any of the abdominal viscera discoverable by the touch, the probability is, that the pulsations are not owing to an internal aneurism.

With the exception of cases, in which these pulsations are owing to mechanical impediments to the circulation, Dr. Albers believes, that they are mostly a symptom of some nervous affection. He also thinks that the surprise, excited by these throbbings, arises only from their strength and situation, other analogous, strong pulsations, as for instance, those of the heart, or of the carotids, being common enough in hypochondriacal and hysterical persons. The same gentleman also adverts to the increased action, which, in inflammation and fevers, is often more conspicuous in some parts of the sanguiferous system, than in others. (*Über Pulsationem im Unterleibe*, p. 63, &c. Bremen, 8vo. 1803.) Much important additional information on this subject may be found in *Observations on some of the most frequent and important Diseases of the Heart; on Aneurism of the Thoracic Aorta; on Preternatural Pulsation in the Epigastric Region*, &c. By Allan Burns; p. 262., &c. 8vo. Edinb. 1809.

ABSCESS. This term signifies a tumour containing pus, or a collection of purulent matter. Authors differ about the original derivation of the word. The most common opinion is, that it comes from the Latin *absedo*, to depart, because parts, which were before contiguous, become separated, or depart from each other.

Abscesses are divided into two principal kinds, viz. *acute* and *chronic*. For every thing, relative to the former, see *Suppuration*; and, for information concerning the

latter, refer to *Lumbar Abscess*. See also *Abdomen, Antrum, Anus Abscesses of, Bubo, Empyema, Hypopium, Mammary Abscess, Whitlow, &c.*

ACETIC ACID, Vinegar. *Distilled Vinegar. Acetum.* Vinegar is an article of very considerable use in surgery. Mixed with farinaceous substances, it is frequently applied to sprained joints, and, in conjunction with alcohol and water, it makes an eligible lotion for many cases, in which it is desirable to keep up an evaporation from the surface of the inflamed parts. Vinegar was once considered as useful in quickening the exfoliation of dead bone, which effect was ascribed to its property of dissolving phosphate of lime. Its application to this purpose, however, seems hardly admissible, for reasons, which will be well understood, from a perusal of what is said on the subject of *Necrosis*. The excellent effects of vinegar, when immediately applied to burns and scalds, were taken particular notice of by Mr. Cleghorn, a brewer in Edinburgh, whose sentiments were deemed, by Mr. Hunter, worthy of publication. (See *Med. Facts and Observations, Vol. II. and the Art. Burns.*)

In chronic inflammations of the eyes, and eyelids, and in certain instances, in which the eyes are weak and watery, vinegar is sometimes recommended as an useful ingredient in the collyrium. After general and topical bleeding, it is said to be an efficacious remedy even in cases of acute ophthalmia. Whenever vinegar is applied to the eye, it is in a diluted state, as may be seen in another part of this work. (See *Collyrium Acidii Acetici.*) In the form of a collyrium, it is alleged to be the best lotion for clearing the eye of any small particles of lime which happen to have fallen into, and become adherent to it, on the inside of the eyelids. (See *A. T. Thomson's Dispensatory, p. 8. Ed. 2.*)

Very strong vinegar may be obtained by freezing and separating the water, which is mixed with the acid. When concentrated, either in this manner, or by distillation, it is said to be an excellent styptic for stopping violent hemorrhage from the nose. With this view, it may be used either as an injection or a lotion, in which lint is to be dipped, and introduced up the nostril.

Vinegar in all its forms is sometimes employed for obviating the smell of sick rooms. The strongest acetic acid which can be made, is found also to be one of the most certain and convenient applications for the destruction of warts, and corns, care being taken not to injure with it the surrounding skin.

ACHILLES, Tendon of. See *Tendons*.

ACIDS. See *Acetic Acid; Muriatic Acid; and Nitrous and Nitric Acids.*

ACTUAL CAUTERY. A heated iron, formerly much used in surgery for the excitation and cure of diseases. The instrument was made in various shapes, adapted to different cases, and it was often applied through a canula, in order that no injury

might be done to the surrounding parts. *Actual* cauteries were so called in opposition to other applications, which, though they were not really hot, produced the same effect as fire, and consequently were named *virtual* or *potential cauteries*. The actual cautery is still in use upon the continent; and by foreign surgeons, we are not unfrequently criticised for our general aversion to what they distinguish by the appellation of an *heroic* remedy. Pouteau, Percy, Dupuytren, Larrey, Roux, and Mauvoisin, are all advocates for the practice; and the latter gentleman, when he was lately in England, took the opportunity of reminding British surgeons of their error, in totally abandoning, as they now do, the employment of heated irons in the business of their profession. (See his *Observations on the Use of the Actual Cautery, Med. Chir. Trans. Vol. IX. p. 364, &c.*)

***ACUPUNCTURE** (from *acus*, a needle, and *pungo*, to prick.) The operation of making small punctures in certain parts of the body with a needle, for the purpose of relieving diseases, as is practised in Siam, Japan, and other oriental countries, for the cure of headaches, lethargies, convulsions, colics, &c. (See *Phil. Trans. No. 148; and With. Ten. Rhyne, de Arthritide, Mantissa Schematica, &c. Svo. Lond. 1683.*) The practice of acupuncture is not followed in England. In a modern French work, it has been highly commended; but, the author sets such a rash example, and is so wild in his expectations of what may be done by the thrust of a needle, that the tenor of his observations will not meet with many approvers. For instance, in one case, he ventured to pierce the epigastric region so deeply, that the coats of the stomach were supposed to have been perforated: *this was done for the cure of an obstinate cough, and is alleged to have effected a cure!* But if this be not enough to excite wonder, I am sure the author's suggestion to run a long needle into the right ventricle of the heart, in cases of asphyxia, must create that sensation. (See *Berlioz, Mém. sur les Maladies Chroniques, et sur l'Acupuncture, p. 305-309, Svo. Paris, 1816.*)

ADHESIVE INFLAMMATION. That kind of inflammation, which makes parts of the body adhere, or grow together. It is the process, by which recent incised wounds are often united, without any suppuration, and it is frequently synonymous with union by the first intention. (See *Union by the First Intention.*)

ÆGYLOPS (from *αἴς*, a goat, and *ὄφθαλμος*, an eye.) A disease so named from the supposition that goats were very subject to it. The term means a sore just under the inner angle of the eye.

The best modern surgeons seem to consider the ægylops, only as a stage of the fistula lachrymalis. Mr. Pott remarks, when the skin covering the lachrymal sac has been for some time inflamed, or subject to frequently returning inflammations, it most commonly happens, that the punc-

ta lachrymalla are affected by it, and the fluid, not having an opportunity of passing off by them, distends the inflamed skin, so that, at last, it becomes sloughy, and bursts externally. This is the state of the disease, which is called perfect *aigylops*, or *agylops*. (*Pott on Fistula Lachrymalis*.)

Aigylops was a very common term with the old surgical writers, who certainly did not suspect, that obstruction in the lachrymal parts of the eye, is so frequently the cause of the sore, as it really is. The skin over the lachrymal sac must undoubtedly be, like that in every other situation, subject to inflammation and abscesses; but, we do not find, that sores unconnected with disease of the lachrymal sac, are here so frequent, as to merit a distinct appellation.

ERUGO (*Subactas Cupri*.) Prepared verdigris is occasionally employed by surgeons as an escharotic. Mixed with an equal quantity of powdered lytta, it is sometimes used as an application for destroying warts and other excrescences. At present, the old practice of attempting to destroy the surface of chancres with it, with the view of hindering the absorption of the venereal poison, and rendering the exhibition of mercury needless, appears to be exploded.

AGARIC. A species of fungus growing on the oak, and formerly much celebrated for its efficacy in stopping bleeding. (See *Hemorrhage*.)

ALBUGO (from *albus*, white.) A white opacity of the cornea, not of a superficial kind, but affecting the very substance of this membrane. The disease is similar to the leucoma, with which it will be considered. (See *Leucoma*.)

ALPHONSIN is the name of an instrument for extracting balls. It is so called from the name of its inventor Alphonso Ferrier, a Neapolitan physician. It consists of three branches, which separate from each other by their elasticity, but are capable of being closed by means of a tube in which they are included.

ALUM. (An Arabic word.) Alum, either in its simple state, or deprived of its water of crystallization, by being burnt, has long been used in surgery. The ingenious author of the *Pharmacopoeia Chirurgica* remarks, that except for external use, as a dry powder, the virtues of alum are not improved by exposure to fire. Ten grains of alum, made into a bolus with conserve of roses, are given thrice a day at Guy's Hospital, in such cases, as demand powerful tonic, or astringent remedies. In a relaxed state of the urinary passages, or want of power of the sphincter vesicae, small doses of alum have been found of service. Alum is employed as an ingredient in several astringent lotions, gargles, injections, and collyria.

It is also recommended by Dr. Perceval as a remedy for counteracting the poison of lead. Burnt alum is a mild caustic, and is a principal ingredient in most styptic powders.

ALVINE CONCRETIONS. Compre-
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hending under this head both gall-stones and intestinal concretions, an interesting subject presents itself, certain parts of which have been chiefly elucidated in modern times, as will be hereafter explained: where the concretions voided are very numerous, they are generally gall-stones. Thus Dr. Coe relates an instance in which seventy were discharged in one day. In the same short time Petermann knew of seventy-two being voided from one individual; Birch, one hundred; Barbette, Sloane, and Vogel, two hundred; and Russell, four hundred. A patient, under the care of Van Swieten, had voided two hundred, and was still continuing to expel others. Riverius speaks of another patient, who had voided calculi from the bowels for several years whenever he went to stool. (*Observ. Commun.*) Fernelius likewise adverts to cases, in which the concretions evacuated were innumerable. (*Pathol. lib. 6. cap. 9.*) But if we take a view of alvine concretions generally, and include all their different kinds, we shall find that they are of various sizes. Most of them are not larger than a pea or nut; but others are as large as an orange, and weigh four pounds. (See *Monro's Morbid Anat. of the Human Gullet, &c. and Medico-Chir. Journ. vol. 4. p. 188.*) Morgagni saw one, which equalled in size a moderate finger, and Gooch, Guettard, Heuermann, Maréchal, *Mém. de l'Acad. Royale de Chir. t. 3. p. 55.*) and others have seen concretions of this nature, which were too voluminous to pass out of the rectum without surgical aid. In certain examples, recorded by Heuermann and Maréchal, the passage of the concretion outward lacerated the sphincter ani. Horstius speaks of one concretion, which was as large as an apple. (*Epist. l. 2. sect. 2. Opp. 2. p. 237.*) and Marcellus Donatus, Schwind, (*Schmucker's Verm. Schriften, 2. b. p. 129.*) Hooke, Vennette, and Hecquet, give the particulars of other examples, in which the concretions discharged were as large as a hen's egg. Mr. Charles White extracted two from the rectum which were nearly as big as the first; (*Cases in Surgery, p. 18.*) and in a boy, who had died in an emaciated state, after continued pain in the abdomen, attended with frequent attacks of ileus, Mr. Hey found in the transverse arch of the colon so large a concretion, that it could not pass any further along the bowel, and appeared to have been the sole cause of the boy's death. (*Practical Observations in Surgery, p. 509, ed. 2.*) An analogous case is also reported by White (*p. 28.*) It is stated, in the *Mém. de l'Acad. de Chir.* that Duhamel saw a concretion that had been discharged, which was two inches and a half in length, one inch and a half in diameter, three inches and a half in circumference, and the weight of which was three drams and a half. But, judging by their weight, how much larger those must have been, which were seen by Scroekius and Lettsom, and weighed ten drams; that reported by Doleus, which weighed two ounces; that recorded by

Orteschi, which, besides weighing two ounces, two drams and a half, is said to have been eight inches in circumference, and to have been taken out by force; that recorded by Schaarschmidt, which weighed four ounces; and lastly the specimen cited by Plouquet, (*Literatura Med. Dig. vol. 1. p. 171.*) the weight of which is alleged to have been half a pound. (*Samm. Med. Wahrnehm. 9. b. p. 231.*) It is observed by Rubini, that although examples of alvine concretions being discharged by vomiting are not so frequent as the foregoing cases; yet they are tolerably numerous. Many of them have been collected by Schenck; and others are recorded by Breyn (*Phil. Trans. No. 479.*) by Orteschi in his Journal; by Moreali (*Dell' Uscita di una Pietra, per la Via del Esophago. Modena, 1781.*); by Borsieri; and by a long list of other writers, whose names and publications are specified by Plouquet. (*Lit. Med. Dig. art. Calculus, Vomitus, &c.*) With this class of substances, says Rubini, may also be arranged those concretions which are found upon dissection, either in the intestines or stomach, whence, probably, in time they might have been expelled. Facts of this description are recorded by Portal, Vicq d'Azyr, Jacquinelle, Chandron, &c. The cases recited by White and Hey, in which the colon was completely obstructed, I have already mentioned; and to these may be added the instance quoted by Rubini, in which Professor Meckel found the jejunum entirely blocked up by a similar substance. (See *Pensieri sulla varia origine e natura de corpi calcicoli, che vengono talvolta espulsi dal tubo gastrico, Memoria, p. 5 and 6. 4to. Verona, 1808.*)

Rubini observes, that, with respect to the origin of alvine concretions, whether discharged from the alimentary canal upwards or downwards, some of them appear to be formed in that canal itself, while others pass into it from other situations; and they all admit of being distinguished according to the place of their origin and formation into three kinds: 1. *hepatic, or biliary*: 2. *gastric, or intestinal*: and 3. (what this author terms) *mixed or hepatico-gastric*. *Hepatic alvine concretions*, as the name implies, are derived from some point of the hepatic system; the *gastric, or intestinal*, are formed within the alimentary canal; and the *mixed* commence in the hepatic organs, but afterwards get into the bowels, where they acquire an increased size.

On the subject of hepatic concretions, or biliary calculi, or gall-stones (as they are usually named,) there is no point of this system in which they do not occasionally form. Riedlin found them in the surface of the liver. Sorbait met with a biliary calculus, as large as a goose's egg, adhering to the peritoneal covering of the liver; and a similar case is recorded by Benivenio. Talon, Pomme, Saurau, and Heberden have seen calculi within the substance of the liver; while Blasius, Fallopius, Columbus, Ruysch, Henricus ab Heers, and Morgagni, record examples in which the concretions

were in the parenchyma of that organ. Plater, Reverhorst, Glisson, Morgagni, and Walther have seen them in the biliary ducts, as probably were those which Columbus and Camenicus say they found in the vena portæ. Walther and Dietrick found calculi in the ductus hepaticus; Ruysch and Soemmering in the ductus cysticus; and Dietrick, Galeazzi, and Richter in the ductus choledocus. Greisel, Benivenio, Eller, Morgagni, Dargeat, and D'Hervillay have seen calculi included in morbid cysts, attached either to the liver or the gall-bladder. The place, however, where calculi are found in the greatest number, and with most frequency, is the cavity of the gall-bladder itself. Here they are sometimes single, their size varying up to that magnitude which completely fills that cavity, as Saye, (*Journ. de Savans, Sept. 1697.*) Halle, and Isenflam have noticed; while sometimes their number amounts to a hundred, or even a thousand, of different sizes. Rubini possesses a gall-bladder which contains above a hundred small calculi; and formerly I had a similar number, which I found in the body of a female. Van Swieten met with a hundred; Haller, a hundred and forty; Stieber, two hundred; F. Plater, three hundred; Walther, five hundred; Mentzki, seven hundred; Baillie, a thousand; Hunter, eleven hundred; Paré, sixteen hundred; Stork, two thousand; and Meckel, several thousands. (*Handb. der Pathol. Anat. b. 2. p. 460.*)

All hepatic concretions, however, are not calculated to pass from the place of their origin into the intestines, but only such as are situated in the ductus hepaticus, or its main branches, in the gall-bladder, the ductus cysticus, or the ductus choledocus. When their size is not disproportionate to the diameter of the ducts, they pass with facility; but when their dimensions are larger than those ducts can naturally admit, the latter become stretched and dilated, whence arise the sharp pains and colic which attend the disorder, analogous to the sufferings produced by the descent of large calculi from the kidneys to the bladder. The reality of these dilatations of the hepatic ducts is proved by dissection. Heister found the orifice of the ductus choledocus, which is usually very small, so much enlarged that it could receive a finger; and Vicq d'Azyr saw this duct enlarged through its whole extent in a similar degree. (*Hist. de la Société Royale de Médecine, an. 1779. p. 220.*) Galeazzi, in dissecting a body, found the ductus choledocus so dilated that it resembled a kind of bag, in which several calculi were included. Mr. Thomas has likewise seen two cases, in which the point of the forefinger readily passed from the duodenum into the gall-bladder. (See *Med. Chir. Trans. Vol. 6. p. 105.*) Morgagni saw this duct in one instance large enough to hold a couple of fingers; and he quotes many similar instances from Bezöld, Trew, Verney, and others. We may conceive how dilated this tube must have been in a case re-

corded by Richter, where, though it was not completely obstructed, a calculus weighing three ounces and a half was lodged within it. (*Rubini, op. cit. p. 7—10.*)

With regard to those concretions which are distinguished by the epithet *gastric* or *intestinal*, some are formed in the cavity of the stomach; the rest in one or other of the intestines. They remain for a greater or lesser period in the place of their formation, according as they happen to be lighter or heavier, smoother or rougher, more or less adherent, or as local or general circumstances are more or less favourable to their retention or expulsion. Sometimes they continue undischarged until they have attained a very considerable size. In particular instances, instead of remaining constantly in one place, they successively pass through the whole length of the intestinal tube, lodging at different points for a greater or lesser time. In the works of Haller and Conradi may be seen representations of the points of the intestinal canal where these concretions have been found. The alvine concretion, of which Maréchal has given an account, was some years in traversing all the convolutions of the bowels. These gastric or alvine concretions, which are very common in animals, are less frequent in the human subject, as the observations of Fourcroy and Vauquelin prove; which are inserted in their valuable essay on this subject in the *Annales du Muséum Nationale d'Histoire Naturelle de Paris*. In the horse they are sometimes of an enormous size, as we may learn from an instance on record, in which the concretion weighed thirteen pounds. (*Voigt, Magazin für das Neueste der Naturkunde, 3 B. p. 578.*)

As for the third species, which Rubini names *mixed* or *hepatico-gastric*, they have their beginning in the hepatic organs, and augment in the intestinal tube. Here, if the extraneous body be detained, and the contents of the bowels have a disposition to become thickened and condensed round it as a nucleus, it may be rendered larger by additional strata of matter, and would increase *sine fine*, if a stop were not put to the augmentation by the narrowness of the canal, or an effort made for the expulsion of the concretion. Morgagni cites two instances of this sort of concretion: one from Gemma, the other from Bezold; and he gives his opinion, that another alvine calculus spoken of by Vater must have been of the same nature. Dr. Coe describes another interesting specimen; and others are referred to by Vandermonde, Moreali, Portal, &c. Perhaps, says Rubini, the instances of this kind would have been more numerous if all the concretions discharged from the bowels had been noted with greater attention, and the hepatico-gastric substances not confounded with the hepatic. The lodgment of these concretions in the intestinal canal is of uncertain duration, and depends upon a variety of circumstances. Vandermonde gives the history of a calculus, which, as far as could be judged of by

the pain in the right hypochondrium, and the change of symptoms, must have passed into the duodenum in the month of January, and then continued in the bowels until August, when it was discharged from the rectum.

The crystallized appearance of alvine concretions is generally so conspicuous that it has not escaped the attention of several of the old writers, as we may convince ourselves of by referring to the works of Corn. Gemma, Greisel, Baglivi, Scultetus, &c. It was noticed by Haller in his *Elementa Physiologiæ*, vol. 6, and by Morgagni in his *Epist. 37, de Sedibus et Causis, &c.* If, says Rubini, these crystallizations are not always plainly visible, distinct, and regular, this depends either upon their imperfection; the heterogeneous nature of the accumulated matter; or particular unfavourable circumstances, which equally affect the process of crystallization out of the body.

Now, as all crystallizations depend upon the fluids, in which they form, and from which they receive their crystallizing elements, it must be evident that, inasmuch as the fluids of the hepatic organs differ in their constituent principles from the fluids contained in the intestinal canal, the concretions produced in the first system must differ from those which originate in the second; whilst the hepatico-gastric calculi will combine the nature and properties of both together.

The fluid from which hepatic concretions are formed is unquestionably the bile, either some or all its ingredients entering into their composition. Indeed, previously to the new chymical doctrines, hepatic calculi were generally considered as being simply condensed indurated bile.

From investigations made in more modern times, however, when the art of analysis has attained a precision of which the old chymistry was not susceptible, it appears, that, although human biliary calculi yield the same products as the bile, there is contained in them more or less of a peculiar substance, which was named by the celebrated Fourcroy, *adipocire*. (*Mém. de l'Acad. des Sciences, 1789. p. 323.*) The presence of this substance in the concretion is of such importance, that, when it is abundant and in large proportion, the calculus is regular, and the crystallization well finished; and when it is in small quantity, the crystallization is confused and disordered, the calculus only exhibiting an irregular misshapen concretion, more like a clot than true crystals. The kind of *adipocire*, which constitutes the base of all human biliary calculi, has some resemblance to spermaceti. Both Fourcroy and Dr. Bostock, who analyzed it, found it composed entirely of carbon, hydrogen, and oxygen. It melts, but requires a heat superior to that of boiling water: in fusion it has a smell like wax; and on cooling, forms a substance which breaks into crystalline laminæ. It is not soluble in alcohol in the cold; but when the alcohol

is boiled on it, it is dissolved in a proportion, according to Fourcroy, of one part in nineteen; according to Dr. Bostock, one in thirty. (*Nicholson's Journ. Soc. vol. 4. p. 137.*) The solution when it cools, deposits light brilliant scales. It is soluble in ether in the cold, and more abundantly if the ether be heated. Oil of turpentine dissolves in general biliary calculi; and, according to Green, it dissolves those which consist almost entirely of this peculiar matter; yet Dr. Bostock has remarked, that oil of turpentine acts on it with difficulty, and even when digested with it, at a boiling heat, dissolves it only in a small degree. Pure soda, and potassa dissolve it completely, and reduce it to a saponaceous state. Ammonia, as Dr. Bostock has remarked, exerts little action on it, except when boiling. Nitric acid dissolves it, and, according to Fourcroy, converts it into a species of liquid similar to the oil of camphor. This, as Dr. Bostock has remarked, becomes concrete, but without any crystalline structure, and is more soluble in ether and the alkalis, than the original matter.

"This substance (Fourcroy has observed,) is contained in greater or less quantity, in nearly all the human biliary calculi, more or less intermixed with other matter, but still so far predominant as to form their basis. Hence, they partake of its properties; are fusible, inflammable, and more or less soluble, in the agents which dissolve it." (See *Murray's Syst. of Chymistry, vol. 4, p. 594, Ed. 2.*) Fourcroy, on exposing the above peculiar substance to the action of oxygenated muriatic acid, saw it whiten, and afterwards resume its former silvery hue. However, Rubini repeated this experiment, and found that the whiteness, which was contracted, remained permanent.

While the hepatic system contains a fluid which is always nearly of the same quality, viz. the bile, the alimentary canal, as Rubini observes, contains a hundred different fluids, and is continually occupied by substances, of various natures, kinds, and properties, consisting of food, drink, and several secretions. All the principles, which are to serve for the formation and renewal of the different species of living solids, and of the many kinds of fluids, at first remain more or less time in the alimentary canal, and there undergo peculiar changes. All the principles, which, under different circumstances, may contribute to the production of morbid concretions, either in the gall-bladder, the urinary bladder, the kidneys, or in any other part of the body, where they ever occur, pass at first into the intestinal canal, where they continue for some time. Such a multiplicity of principles, disposed to crystallize, and be converted into calculi, would very often, almost daily, produce these concretions in the bowels, were there not many circumstances, which counteract this tendency, as, for instance, exercise, the incessant motion of the matter

itself along the intestinal tube, the variety of these elements, whereby their requisite tendency to unite is disturbed, and the decomposing and recomposing influence of the gastric secretions, whereby parts are united, disposed of, dissolved, and analogous matter kept divided, &c. But, whenever these circumstances are not actively operating, as may be the case in a noose, or fold of the bowels, or in some preternatural cyst belonging to them; whenever the intestinal fluids undergo such an alteration, that the production of these concretions cannot be prevented; or, lastly, whenever some favourable circumstance, such as an extraneous nucleus, forms a centre of reunion for particular elements; then the saline matter, which is most disposed to crystallize, and the earthy and mucilaginous substances, &c. are attracted together, and produce more or less perfect crystallizations. A chymical analysis of some intestinal calculi, first made by König, and afterwards by Slare, (*Philosophical Transactions*) proves that when they are exposed to a strong heat in distillation, they yield water, ammonia, and a lixivious salt, a caput mortuum remaining behind. Cadet, in analyzing a similar concretion, found, in addition to the above products, phosphorus. The muriate of ammonia was afterwards discovered; and Gioberti, Fourcroy, and Vauquelin, in their histories of the intestinal concretions, met with in animals, describe them as composed of the acidulous phosphate of lime, phosphate of magnesia, and of the ammoniacal-magnesian phosphate.

Some specimens, contained in the Edinburgh museum, were very carefully examined by Dr. T. Thomson: they at first swam in water, but afterwards sunk; the specific gravity varying from 1.376 to 1.540. Cold water, acquired from them a brownish tinge, and took up albumen, which separated in white flakes by boiling. There was also a peculiar brown substance, at first dissolving in water, but rendered nearly insoluble by slow evaporation; soluble in alcohol; and most nearly resembling vegetable extract. The specimens likewise contained muriate of soda, crystallizing on spontaneous evaporation of the water: phosphate of lime, precipitated by ammonia; sulphate of soda in minute proportion; and, perhaps, sulphate of lime. Alcohol dissolved the peculiar brown matter and some of the salts; caustic potash, the albumen, brown matter, and perhaps some of the salts; and muriatic acid a proportion of phosphate of lime. After all, there remained a peculiar substance, having the colour and texture of the calculus; in very short threads, light, resembling cork, or rather agaric; tasteless, insoluble in water, alcohol, ether, potash-ley, and muriatic acid; being blackened, and partly reduced to charcoal by sulphuric acid; slowly dissolving by heat, without effervescence, in nitric acid; and leaving on evaporation a whitish residue, of bitter taste, and imperfectly soluble in water;

burning with a bright flame; but differing from all other animal and vegetable substances hitherto examined, and distinguishable from wood, by its insolubility in potash-ley. The calculi consisted of alternate layers, or intimate mixtures of this substance and phosphate of lime, to which the albumen and brown matter served as a cement, the other substances being in small proportions. Phosphate of lime, mixed with a brown animal matter, formed the external crust of some of the specimens. On the surface of a few were noticed crystals of phosphate of ammonia and magnesia. The presence of neither potash, ammonia, carbonate of lime, uric acid, nor urea, could be detected.

Varieties have also been found by Dr. Henry and Mr. Brande, which were exclusively composed of magnesia, of which the patients had been in the habit of taking vast quantities. (See *Thomson's Obs. in Monro's morbid Anatomy of the human Gullet*, &c. p. 36, or in *Medico-Chir. Journ.* vol. 4, p. 188, 189.)

From some recent observations made by Dr. Wollaston, it appears probable, that the above fibrous light thready substance is derived from oats, which are so commonly taken as food in Scotland.

"If the oat-seed be divested of its husk, minute needles or beards, forming a small brush, are seen planted at one of its ends. Dr. Wollaston, on examining these needles, and comparing them with similar ones detached from the calculi, and forming the velvet substance in question, satisfied himself beyond all doubt of their perfect identity." (*Marcet on calculous Disorders*, p. 180, *8vo.* London, 1817.)

As for the mixed, or hepatico-gastric calculi, they have for their nucleus a biliary concretion, round which other substances contained in the bowels adhere: hence, it is evident, that as they are formed at two distinct periods, in two different situations, and among various fluids, two distinct compositions must be the result. Although, says Rubini, there has hitherto been no scientific analysis of this species of calculus, excepting the very imperfect one by Moreali, reason shows clearly enough that, if two separate analyses were made, one of the nucleus, the other of the surrounding matter, there would be obtained from the nucleus the same elements, as those of an hepatic calculus, and from the rest those of an intestinal concretion. (See *Pensieri sulla Varia Origine, &c. de' Corpi calcolosi che vengono espulsi dal tubo gastrico*, p. 16—17.)

As the same author remarks, the foregoing principles will enable us to determine with greater precision, than formerly, the characters, which appertain to the several classes of calculi, liable to be voided from the intestinal canal; characters, by means of which there can be no difficulty in deciding, from the appearance of one of these concretions, the place of its origin, and its peculiar nature. The hepatic calculus, being composed of bile, and also of *adipocire*,

its characters will be such as indicate the predominance of an uniform, oleaginous, and (what Rubini terms) a well *animalized* principle. The gastric, or intestinal calculus, arising from the union of various salts, earths, and other principles, which happen to be in the alimentary canal, will have very different characters, generally indicating its earthy, saline composition. Lastly; the hepatico-gastric calculus will present an union of the different characters; viz. in the centre, the characters of the hepatic calculus; more externally, those of the gastric.

The criteria for distinguishing the several kinds of calculi from each other, may be divided into two classes; those which may be termed *external*, being derived from accidental circumstances attending the foreign body; and others, which may be called *internal*, being deduced from the inherent characters, belonging to the composition and nature of these concretions.

The first of these external criteria, is the age of the patient. C. Stephanus, Hoffmann, Durande, and Morgagni all agree, that biliary calculi seldom occur, except in subjects of advanced age, and never in youth. And Haller writes, "*Juniores et pueros, quantum novi, numquam adligit morbus.*" Morgagni states, that he has met with sixty-one old persons who had alvine concretions, but only eight young persons, not one of whom was a child, the youngest being twelve years of age, and the eldest twenty-nine. To these I may add the instance, reported by Saye, in which a stone as large as a hen's egg, was found in the gall-bladder of a young female aged only twelve. (See *Journ. des Savans*, Sept. 1697.) The cause of this difference is attempted to be explained by Morgagni; but probably a more rational explanation than that suggested by him, will be found in the analysis of the bile of old and young subjects, as made by Fourcroy and other modern chymists. From these and other observations, collected by Rubini, it is rational to conclude, that when an alvine concretion is discharged from a young subject, the chances are that it is not a biliary one; though, if the patient be of advanced age, it is not to be inferred, that the foreign substance expelled must certainly be hepatic, because gastric or intestinal concretions are common to individuals of every age. (*Rubini, op. cit.* p. 18.) Indeed, with the latter kind of calculi, men of advanced age and women are said to be most frequently afflicted; children and young persons rarely suffering, unless the formation of such bodies has been produced by the presence of fruit-stones, or other indigestible substances, which serve as nuclei. (See *Richerana's Nosographie Chir.* T. 3. p. 433, Ed. 4.) These concretions have likewise been noticed in patients, who have been confined by disease a long while in a recumbent posture.

With respect to another criterion, deduced from the patient being also afflicted with urinary calculi, there cannot be a doubt of

its invalidity, though proposed by so great a man as Morgagni. The concurrence of the two disorders in the same individual, when it happens, is purely accidental. Suffice it to add, that Haller, in his pathological works, expressly mentions the rarity of urinary calculi at Gottingen, where cases of gall-stones are extremely frequent.

A third criterion is drawn from the symptoms which precede, or accompany the expulsion of the calculus. Sense of heaviness, irritation, and pain in the region of the liver, pain about the ensiform cartilage and navel, bilious vomiting, jaundice, and either looseness of the bowels or constipation, are the symptoms, which (especially when they frequently occur) indicate the hepatic origin of the calculus, and proceed from its passing through the narrow ducts of the liver or gall-bladder towards the intestines. The most careful observations have proved, however, that these symptoms are only to be depended upon when taken collectively, and that no single one gives any certain information. Also, if their presence be sufficient to prove the hepatic origin of the calculus, their absence can by no means be regarded as a proof of the concretion being of the intestinal kind. (*Rubini, p. 19.*)

Fourth criterion. A calculus voided may be set down as undoubtedly hepatic, if accompanied by others, which are unequivocally of this nature. In a case recorded by Brunner, and in another by Vater, the absence of certain symptoms in the first, and the magnitude of the calculus in the second, created doubts whether the concretions were not more likely to be of the intestinal kind, than of the hepatic. At length, the bodies having been opened, the presence of other similar calculi in the gall-bladders afforded an adequate criterion.

Morgagni lays down a fifth criterion, deduced from the number of the calculi voided; which, if very numerous, are to be considered as biliary. Rubini points out, however, the fallacy of this test; both hepatic and gastric concretions being sometimes single, sometimes in various numbers, even up to a thousand; and he refers to a case where a very large number of concretions of the gastric description were voided, as reported by König. The test, here suggested, however, may be considered as generally valid: for, the number of intestinal concretions is rarely more than two, though sometimes very considerable. (*T. Thomson. See Med. Chir. Journ. Vol. 4, p. 189.*)

I shall now follow Rubini, and notice those characters of alvine concretions, which he calls *internal*, and are deduced from their quality and composition, beginning with the criterion furnished by the size of the extraneous substance voided. As the biliary ducts are narrow, it is obvious that, if the calculus be above a certain size, it cannot have passed through those narrow tubes, and consequently must be either of the gastric description, or mixed, having quitted the hepatic system when it was

small, and afterwards increased within the alimentary canal. Unquestionably, as Rubini admits, this criterion has considerable weight, especially when the discharge of the calculus has not been preceded by pain, or other symptoms indicating such violent distension, as the above ducts must have suffered from the passage of the foreign body. These may certainly be dilated in a remarkable degree; but, it can never happen without pain, irritation, and a serious train of sympathetic effects. The case in which the dilatation takes place slowly and insensibly, if not hypothetical, is uncommon. This criterion is adopted by Moreau in the *Mem. de l'Acad. de Chirurgie*; and Bonté has availed himself of it in *Vandermonde's Journal*, for determining, that a calculus, of which he has published an account, was first formed in the hepatic organs, and then attained a larger size in the intestinal canal. As Rubini remarks, however, it is plain, that this criterion will only apply to large, and not to diminutive concretions.

A second criterion is the colour of the calculus; a test admitted by Moreau; who asserts, that biliary calculi are yellow, or green, and intestinal ones grayish brown, or black. But, says Rubini, one need only look at various specimens of alvine concretions, and read the statements of authors, who have seen a great many of them, particularly Morgagni and Soemmering, to comprehend, that any criterion, deduced from their colour, is most fallacious. Every species of them presenting great variety in this particular. And, it is to be remembered, that the bile and the intestinal fluids, whence these concretions are formed, differ in colour in different individuals, according to a variety of circumstances, in health and disease. The smaller intestinal concretions, examined by Dr. T. Thomson, destitute of coating, resembled bad yellow ochre; the larger were encrusted with an earthy matter, of a coffee colour, and purple, or sometimes white. (*See Monro on the Human Gullet, &c. and Med. Chir. Journ. Vol. IV. p. 188.*)

Third criterion. The presence or absence of a nucleus will enable one to judge, whether a calculus be gastric, or hepatic. A biliary concretion has no nucleus, properly so called; that is to say, it has no foreign body in its centre. When a transverse section is made of such a calculus, one either finds a cavity in its middle, or else nothing, by which this part of its substance can be distinguished from the rest; or, if a nucleus, different from the other part of the concretion, be apparent there, it consists merely of bile, either grumous, differently coloured, or more or less fluid, than the rest of the calculus, but which is nevertheless invariably bile. On the contrary, every gastric concretion has, as it were, an extraneous nucleus, as Fourcroy and Vanquelin have explained in their essay upon the intestinal calculi met with in animals. Ruysch in the *Phil. Trans.* gives an account of some alvine concretions

which were formed round grains of seed. Birch records an example of a crystallized calculus, formed round a leaden bullet. Haller met with a calculus, in the centre of which was an iron nail. Concretions, formed upon fruit-stones, are recorded by Clarke, White, and Hey, and also in the Edinb. Med. Essays. Instances, in which the nucleus was a small portion of bone, are related in the latter work, and also by Hooke, and Coe. Homberg and others describe alvine concretions, formed round indurated excrementitious matter; and many similar cases are specified by Vallisnieri, Vanswieten, and others. In the hepaticogastric calculus, the biliary concretion serves as a nucleus for the gastric. According to Dr. T. Thomson, the nucleus is commonly a cherry-stone, a small piece of bone, or a biliary calculus. (See *Med. Chir. Journ.* Vol. IV. p. 188.)

A fourth criterion is deduced from a certain unctuousity, which belongs to biliary calculi, but not to those of the gastric class. This character is more palpable, when the calculus has been recently voided, or when it is handled with warm fingers. The unctuousity is still more evident, when the concretion is cut, or sawn, as then the knife, saw, or fingers, become smeared with saponaceous particles, which adhere to them. In order to denote an hepatic calculus, however, the unctuousity must pervade its whole substance, and not merely appear towards its outside; for, a gastric, earthy, saline concretion may by accident become coated, as it passes through the bowels, with a stratum of bile, or saponaceous matter. When the unctuousity is deficient externally, or in the outer laminae of a calculus, but is found in its interior, when cut, it is a clear indication of the hepaticogastric formation of the concretion.

Fifth criterion. The specific gravity of a calculus, the property which it has of floating or sinking in water, has been long considered as a test of its species. The hepatic calculus is generally specifically lighter than water, as most oily substances are: on the contrary, gastric calculi are specifically heavier than water, like all earthy saline matter, and of coarse sink in that fluid. This criterion was often employed by Reverhorst, Fernelius, and others, for distinguishing various concretions. But, it is by no means regular, as many biliary calculi swim only a little while, and then sink. The specific gravity of that analyzed by Dr. Ure of Glasgow, was 1.0135. (See *Med. Chir. Journ.* Vol. IV. p. 179.) Rubini observes, this test will not answer for hepaticogastric calculi, which are subject to great anomalies. (*Pensieri*, &c. p. 22.) Nevertheless, the most correct modern examinations prove, that gastric concretions have a specific gravity, varying from 1.376 to 1.540, (Dr. T. Thomson in *Monro's Morb. Anat.*, &c.) and, consequently, their general character is to be heavier than biliary calculi.

A sixth criterion is that proposed by Vicq d'Azyr, in the *Mém. de l'Acad. Royale*

de Med. and deduced from the figure of the crystallization. According to this writer, intestinal concretions crystallize in concentric laminae, shaped like a cock's comb, while the crystallizations of biliary calculi are radiated and needle-shaped. Although this criterion is ingeniously founded upon the known laws, by which every crystallized substance assumes a peculiar and determinate shape, yet it may be generally observed, with respect to the mark of distinction here proposed, that the concretions, of which we are now speaking, are usually too compound, and too much disturbed in their crystallization, to exhibit a regularity, for which simplicity and quietude are indispensable. Hence, many of these concretions do not present the slightest vestige of crystallization, while others scarcely show a trace of it, in the midst of a large misshapen mass. With respect to the special shape assigned by Vicq d'Azyr, to the two classes of alvine concretions, it may be observed, that his specimens were taken from animals, and that consequently, the inferences made from them are not applicable to substances of an analogous nature. discharged from the human body; because, as the bile varies in different animals, so must the formative principles of the calculus crystallizations. It is further remarked by Rubini, that the substance termed *adipocire*, which is the basis of biliary concretions, was not found by Poulletier in hepatic calculi taken from horned cattle.

A seventh criterion is founded upon the inflammability of an alvine calculus. A biliary concretion being commonly made up altogether of unctuous matter, liquefies when subjected to heat, smokes, emits a flame, and burns. When this experiment is made in close vessels, the products are hydrogen, carbonic acid gas, oil, and ammonia; some carbon and earth remaining behind. An intestinal concretion, on the other hand, decrepitates, or turns black, but does not burn.

The eighth criterion depends upon the solubility of calculi in an oily menstruum. Haller dissolved biliary calculi in oil of turpentine; Dietrick found them soluble in oil of sweet almonds; and Gren in oils in general. But, intestinal calculi are not so readily dissolved by any of these menstrua.

The ninth criterion is founded upon the solubility of the calculus in alcohol. In biliary calculi, this solubility is not always the same. Having already spoken upon this point, however, it is unnecessary to dwell upon it; and I shall merely add, that while hepatic concretions are always more or less dissolved by alcohol, those of the gastric kind resist this menstruum.

Though the above criteria are interesting, as tending to establish distinctions betwixt the different species of alvine concretions, it merits attention, that not one of them, taken separately, is at all certain and pathognomonic. It may happen, says Rubini, that some peculiarity in the biliary secretion, and an irregularity in the crystalli-

zation and accumulation of the matter, may cause salts and earths to predominate in hepatic concretions, in which circumstance, their usual oily quality will be defective. On the other hand, in the formation of an intestinal concretion, oily adipose matter may accidentally adhere to it, so as to disguise its wonted character. If uniformity of characters and physical properties depend upon uniformity of elementary constituent principles, it can hardly happen even in the natural healthy state of the secretions, because age, sex, and other particular circumstances of the individual, will always make a difference in the proportions of those principles. How then can identity of results be expected in a diseased state of the process of secretion?—Such reflections may explain, how Morgagni, among others, met with many biliary calculi, which were not inflammable; with others, which did not give a yellow tinge to water; and with some which floated, or sunk in water, according as they had been recently, or long discharged; while Gren found some of these calculi insoluble in alcohol, &c. (Rubini, p. 24, 25.)

Moreali put a piece of the outer part of an alvine concretion into nitrous acid, when a considerable effervescence took place, and the substance afterwards completely dissolved. Now, as this calculus had a nucleus, it must have been of the hepato-gastric kind, and the experiment was therefore made only with the intestinal part of it. Should the experiment be often repeated with the same result, says Rubini, it would furnish another criterion for distinguishing the two species of calculi; those being intestinal, which effervesce, and others being hepatic, which do not effervesce, but yield globules of wax-like oily matter. (p. 28.)

For additional chymical observations on biliary and other alvine concretions, the reader is particularly referred to Rubini's interesting memoir, Vicq d'Azyr's essay in the *Hist. de la Societ  Royale de M decine*, an. 1779; the writings of Fourcroy and Vauquelin; Thomson's account of the subject in *Monro's Morbid Anatomy of the Human Gullet*, &c.; Marcet on calculous Disorders; and some interesting experiments by Dr. Ure, related in a paper by Mr. Kennedy, in *Medico-Chir. Jour.* Vol. 4. p. 177, &c.

With respect to the treatment of cases of biliary calculi, the subject not being generally one, for which any surgical proceeding is advisable, I may be very brief. The medicine, which is alleged by Durande, a physician at Dijon, to be the best solvent for them, consists of three parts of sulphuric ether, and two parts of oil of turpentine. It is to be given in the dose of  ij every morning; purgatives being previously exhibited for a few days. The efficacy of this medicine is also corroborated by Soemmering and Richter. To these statements, however, some doubts must be attached, because what symptoms and cir-

cumstances will ever unequivocally prove, that there were biliary calculi in the bowels; and that they have been dissolved by this medicine? And how can the product of such solution be got at and examined? But, admitting the authenticity of the cases, doubts must exist of the solvent action of the remedy, since at a temperature, below that of the human body, the ether separates from the turpentine and is volatilized. (See *Dict. des Sciences Med.* T. 3, p. 464, 465.)

A calculus in the gall-bladder, or one of the biliary ducts, sometimes produces so much irritation, that inflammation and supuration take place, and if the abscess point outwardly, the stone may escape externally, and a termination be put to the patient's sufferings. Heberden records a case of this description; and another is given by Mr. Blagden. (See *Med. Trans. of the College of Physicians*, Vol. 5. and *Thomas in Med. Chir. Trans.* Vol. 6. p. 106. And for other instances, the following works referred to by Plouquet: *Acetel. Diss. de Cholelithis*, Upsal, 1788. p. 204; *Act. Natur. Cur.* Vol. 6. Obs. 69; *Bartholinus, Act. Hafn.* 4, Obs. 46; *Block, Med. Bemerk.* p. 27; *Gooch's Works*, Vol. 2, 157—161; *Johnston in Phil. Trans.* Vol. 50, p. 2, 548; *Petit, M m. de l'Acad. de Chir.* 1, p. 182—185; *Sandifort, Tab. Anat. Fasc. 3*; *Schlichting in Bald. N. Magaz.* 9 b. p. 210; *Vogler in Museum der Heilkunde*, 4 b. p. 91; *Haller, Collect. Diss. Pract.* 3, No. 107.)

The eminent J. L. Petit, as is well known, suggested the bold practice of making, under certain circumstances, an incision into the gall-bladder, in order to extract biliary calculi. This proceeding is liable to serious objections, arising not only from the usual difficulty of knowing positively that there is a calculus in the gall-bladder, but also from the difficulty of ascertaining that this viscus is adherent to the peritoneum, without which state of things, the operation would cause an extravasation of bile, enteritis, and death. Petit himself, indeed, mentions three cases, in which distention of the gall-bladder was mistaken for an abscess, and punctured. In two of these examples, the consequences were fatal, there having been no adhesion between that organ and the peritoneum to prevent the bile from getting amongst the bowels; the other patient was saved by this fortunate circumstance. (See *Traitt  des Mal. Chir.* T. 1, 262, &c.) However, if a case were to present itself in which an abscess had formed, and broken, leaving an aperture in which the calculus could be plainly felt, the surgeon would be justified in attempting to make a sufficient opening for its extraction.

The symptoms, induced by the lodgment of large concretions in the bowels, are of a formidable description: severe pains in the stomach and bowels, diarrh ea, violent vomitings of blood and mucus, a discharge of thin fetid matter from the rectum, a difficulty of voiding the excrement, an afflicting

tenesmus, extreme emaciation, and debility.

That the foregoing account is not at all exaggerated, may be seen by a perusal of the cases, and remarks published by Mr. C. White of Manchester, and Mr. Hey of Leeds.

In cases, like that reported by Mr. Hey, (*Pract. Obs.* P. 509. *Ed.* 2.) where the colon was entirely obstructed, surgeons have been advised to cut into that bowel, and extract the foreign body. Let the inexperienced admirer of curious feats, with the scalpel, however, pause a little, before he ventures to make up his mind upon this matter; and, at all events, let him know that some serious mistakes have nearly been made "upon the very bold operation of cutting out these concretions, when lodged in the colon, proposed by Dr. Monro senior, (See *Monro's Morbid Anatomy of the Human Gullet*, &c. P. 63.) we think it our duty to state, that the diagnosis is so difficult, that, in one case, where the operation was strongly advised, it turned out, upon dissection, that the disease was a *scirrhus pylorus*." (See *Edinb. Med. and Surg. Journ.* No. 33. P. 112.)

Sometimes patients ultimately get well by voiding the concretions either by vomiting or stool. Mr. Charles White gives us an account of some such instances; in one fourteen concretions on plum-stones were discharged from the anus; in another twenty-one similar bodies were ejected from the stomach.

When such concretions are not particularly large and indurated, they sometimes admit of expulsion by doses of castor oil, oleaginous clysters, &c. But, in other instances, their extraction must be attempted, if their situation in the rectum will permit. It may be done with a pair of lithotomy forceps, or with the sort of scoop used for taking fragments of stone out of the bladder. In this manner Mr. C. White succeeded in removing two alvine concretions from the rectum, nearly as big as his fist. When the sphincter ani will not allow the concretion to be taken out, the muscle should be divided at its posterior angle. According to Richerand, such a division does not permanently weaken its fibres in a perceptible degree, and its paralysis never originates from this cause. (*Nosogr. Chir.* T. 3, p. 434. *Edit.* 4.) Maréchal, after a proper dilatation with a scalpel, extracted from the rectum an alvine concretion, which weighed two ounces and a half, and was of an ovoid form, its greatest diameter being two inches eight lines, and its smaller one inch seven lines. (See *Mém. de l'Acad. de Chir.*)

A. Petermann, *Scrutinium Icteri ex calculis vesiculæ Felle, occasione casus cujusdam singularis.* Lips. 1696. Alb. Haller, *De Calculis Felleis frequentioribus Observationes*, 4to. Gott. 1749. T. Coe, *A Treatise on Biliary Concretions*, 8vo. Lond. 1757. Ambert, *De Variis Calculorum Biliarum Spec-*
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ciebus, &c. 4to. Monsp. 1768. De Vries, *Diss. de Calculo Biliario, et sectione fellæ vesiculæ*, 4to. Traj. ad Rhen. 1759. Walther de *Concrementis Terrestribus in variis partibus corporis humani repertis.* Fol. Aerol. 1775: the most valuable work on the subject at this period. Hochstetter, *De Cholelithis Humanis*, 4to. Tub. 1763. Vicq d'Azyr, *Hist. de la Société Royale de Méd.* 1799. An exceeding valuable production, particularly as far as regards the kinds of crystallization observable in hepatic and intestinal calculi. Durande, *Mémoire sur les pierres biliaires, et sur l'efficacité du mélange d'éther vitriolique et d'esprit de terebinthine dans les colique hépatique produites par ces concrétions*, dans vol. 1 des *Mém. de l'Acad. de Dijon*, 8vo. p. 199. an. 1783. S. T. Soemmering, *De Concrementis biliariis Corporis humani*, 8vo. Traj. ad Rhen. 1795. B. Brunie, *Essai sur les Calculs biliaires*, 4to. Paris, 1803. Fourcroy, *Mém. de l'Acad. des Sciences*, 1789. and *Syst. des Connoissances Chim.* T. 10, p. 53—60. Dr. Bostock, in *Nicholson's Journal*, Vol. 4, p. 137. Marcet's *Chymical History and Medical Treatment of Calculous Disorders*, 8vo. Lond. 1817. J. F. Meckel, *Handbuch der Pathol. Anat.* B. 2, p. 455, &c. Leipz. 1818. P. Rubini, *Pensieri sulla varia Origine e Natura de Corpi calcolosi che vengono talvolta espulsi dal Tubo Gastrico Memoria*, 4to. Verona, 1808. James Kennedy, *An Account of a Morbid Concretion discharged from the Rectum of the Human Female, and in its Chymical Characters closely resembling Ambergris; with Historical Remarks: see Medico Chir. Journal*, Vol. 4. p. 177, &c. 1817. This paper contains a good deal of useful matter, deserving the notice of every body wishing to investigate the history and nature of alvine concretions. *Monro's Morbid Anatomy of the Human Gullet, Stomach, and Intestines*, 8vo. Edinb. 1811. The account of alvine concretions in this work is one of the best and most comprehensive. *Dict. des Sciences Med. art. Bazoard, et Calculs Biliaires.* Nothing of much consequence in either of these articles. *Moscovius, Diss. de Calculorum Animalium eorumque in primis biliosorum origine et natura.* Berol. 1812. *Cases in Surgery*, by C. White, 8vo. Lond. 1770, p. 17. *Philos. Trans. abridged*, Vol. 5, p. 256, et seq. *Edinb. Med. Essays and Obs.* vol. 1, p. 301. *Ibid.* vol. 5, p. 431. *Essays Phys. and Literary*, vol. 2, p. 345. *Leigh's Natural History of Lancashire*, plate 1, fig. 4. *W. Hey's Practical Obs. in Surgery*, p. 507, ed. 2. Richerand, *Nosographie Chirurgicale*, t. 3, p. 433. ed. 4. Thomas, in *Med. Chir. Transactions*, vol. 6, p. 98.

*AMAUROSIS (from *αμαρωπος*, to obscure.) *Gutta serena. Suffusio nigra.* Fr. L'Amaurose; Germ. Schwarzer Staar. According to Beer, the term amaurosis properly means that diminution or total loss of sight, which immediately depends upon a morbid state of the retina and optic nerve, whether this morbid state exist as the only defect, or be complicated with other mischief; whether it be a primary affection, or a secondary

one, induced by previous disease of other parts of the eye.

From this definition, which comprehends every form of amaurosis, it is evident that this affection does not uniformly take place as a single independent disorder; but not unfrequently presents itself as a symptomatic effect of some other disease of the eye; a fact exemplified in cases of hydrophthalmia, cirsophthalmia, glaucoma, &c. And as Mr. Wardrop observes, amaurosis, in its usual acceptance, signifies a symptom of disease, as well as a distinct affection. (*Essays on the Morbid Anatomy of the Human Eye*, vol. 2. p. 165. 8vo. Lond. 1818.) With respect to the mere name of the kind of disease, which is here implied by amaurosis, its correctness will remain the same, whether the iris be moveable or immovable; whether the pupil be preternaturally enlarged or contracted; and whether it be perfectly clear and transparent, or more or less turbid; for the name only refers to the morbid state of the retina and optic nerve, and not to the condition of the sight in general. When the long-established name of *amaurosis* is received with this precise meaning, there will not be the slightest danger of confounding this disease with other affections of the eye. However, when it is wished to make out the very different forms and kinds of amaurosis, the foregoing appearances of the iris and pupil are considerations of great importance. (See *Beer's Lehre von den Augenkrankheiten*, b. 2. p. 420, &c. Wien. 1817.)

Amaurosis does not constantly attack both eyes at the same time. Frequently one is attacked some time after the other; and it is not unusual even for one eye to remain sound during life, while the other is completely blind. This depends in part upon the disposition to the disease in one eye being quite local, and in part upon the causes giving rise to the complaint extending their operation only to the eye affected. Where, also, the origin of amaurosis seems to depend altogether upon constitutional causes, as in gouty and syphilitic patients, &c., one eye is not unfrequently attacked much sooner than the other; though, in these examples, it is more rare to find the eye, which does not suffer at first, continue perfectly unaffected. (*Beer*, b. 2. p. 422.) As a general observation, Mr. Wardrop thinks it may be remarked, that, when only one eye becomes at first amaurotic, from a sympathetic affection, there is little danger of the other eye becoming blind; but, that when amaurosis is produced by any organic change in one eye, the other is in danger of becoming sympathetically affected. (*Essays on the Morbid Anatomy of the Human Eye*, vol. 2. p. 190.) Amaurosis does not completely hinder vision, a diminished power of seeing often remaining during life. Hence the division of cases into *perfect* and *imperfect*, which latter, however, sometimes attain a degree in which the patient is only just able to

distinguish light, the direction of its rays, and its degree.

Imperfect amaurosis, besides being characterized by a considerable weakness of sight, approaching to real blindness (*Amblyopia Amaurotica*), is mostly complicated with a greater or lesser number of other morbid appearances, which merit serious attention.

Among the most important of these symptomatic appearances of imperfect amaurosis, is a defective interrupted vision (*visus interruptus*.) For instance, when the patient is reading, single syllables, words, or lines, cannot be seen, unless the eye be first directed to them by a movement of the whole head, and greater or lesser portions of other objects are, in the same manner, undistinguishable. Sometimes amaurotic patients can see only the upper or lower, or the left or the right half of objects. (*Visus dimidiatus*; *Amaurosis dimidiata*; *Hemiopia*; *Hemiopsia*.)

Sometimes, when the patient shuts one eye, he can only distinguish the halves of objects; but, if he open both eyes, he sees every thing in its natural form. In this case, according to Schmucker, one eye is sound, and only some fibres of the nerve of sight are injured in the other. (*Vermischte Chir. Schrift*. b. 2. p. 12.)

There are likewise some not very uncommon cases of imperfect amaurosis, in which the patient cannot see an object, unless it be held in a particular direction before the eye; but when the eye or head is moved in the least, he loses all view of the thing, and cannot easily get sight of it again. (*Beer, Lehre von den Augenkrankheiten*, b. 2. p. 424.) On this part of the subject, it is remarked by Richter, that patients who may be said to be entirely blind, sometimes have a small part of the retina which is still susceptible of the impression of light, and is usually situated towards one side of the eye. This obliquity of sight was long ago pointed out by the late Mr. William Hey of Leeds, as common in the present disease. (See *Med. Observations and Inquiries*, vol. 5.) Richter mentions, that, in one man, who was in other respects entirely bereft of vision, this sensible point of the retina was situated obliquely over the nose, and so small, that it was always a considerable time before its situation could be discovered. He adds, that it was so sensible, as not only to discern the light, but even the spire of a distant steeple. According to this author, it is the centre of the eye that seems to be the first and most seriously affected in the gutta serena. Hence, the generality of patients, who have a beginning imperfect amaurosis, can always see objects laterally situated better than those which are immediately before them. (*Anfangsgr. der Wundaren*. b. 3. Kap. 14; also *Hey in Med. Obs. and Inq.* vol. 5.)

One of the most common symptoms of a beginning amaurosis is an appearance in the patient's fancy, as if gnats or flies were flying about before his eyes. (*Visus Mus-*

varum, Myodesopsia.) Sometimes transparent, dark-streaked, circular, or serpentine diminutive bodies appear as if flying in greater or lesser numbers before the eyes, often suddenly ascending, and as quickly falling down again, and chiefly annoying the patient and confusing his sight when he looks at strongly illuminated or white objects. The substances thus appearing to fly about before the patient's eyes are termed by writers *Scotomata*, *Musca volitantes*, *Mouches volantes*. (Beer, *Lehre*, &c. B. 2. p. 424.) The term *scotoma*, however, is not always received exactly in the foregoing sense; for, Richter says, sometimes the malady seems to be confined to a single little spot in the eye, in which case, the patient is conscious of having before the retina an immoveable black speck. It is to this particular instance that some pathologists apply the term *scotoma*.

These scotomata gradually increase, become less and less transparent, and at length, are so connected together, that they form a kind of network, or gauze, by which all objects are more or less obscured. This is another symptom of amaurosis, technically called *visus reticulatus*. The network commonly has the peculiarity of being black in very light situations, or when white substances are before the eye; while, in dark places, it is quite shining, and, as it were, of a bluish white hue, like silver, though sometimes of a red-yellow, golden colour.

A not uncommon symptom of imperfect amaurosis is the patient's seeing every object indistinctly in a rainbow-like, sometimes tremulous, and generally very dazzling light; while, in the dark especially, blue or yellow flashes, or fiery balls seem suddenly to pass before his eyes when the eyelids are shut, and excite considerable alarm. (*Visus lucidus*; *Marmoryge Hippocratis*; *Photopsia*.)

In imperfect amaurosis, the sensibility of the retina may be so augmented, that the patient shuns all very light places, particularly those in which the light is strongly reflected into the eye, and, in order yet to discern in some measure large objects, he feels himself obliged always to seek shady, darkish situations, or to screen his eyes, out of doors, with a green shade, or green glasses. This state is termed by Beer, *Lichtscheue*. (*Photophobia*.) Under these circumstances, it sometimes happens, that the patient for a very short time, for example a few moments, or (what is very uncommon) for a more considerable period, is able of himself to discern the smallest objects in a very weak light more plainly and accurately than the best eye can hardly do in a good light. Yet, excepting at such period, the patient with the above degree of light is not capable of seeing even larger objects. This infirmity of sight receives the name of *oxyopia*.

Sometimes, in the early stage of amaurosis, all objects seem covered with a dense mist; while, in other instances, this mist first presents itself as a simple, continually

increasing scotoma, and rarely in the form of a network, or gauze; but to the patient, when his blindness commences with the *visus nebulosus*, the mist usually appears for a day or two of a light gray colour, and then for another day or two very black, every thing appearing as if looked at through a dense sooty smoke. (Beer, *Lehre von den Augenkrankheiten*, B. 2, p. 422—26.)

To an eye affected with imperfect amaurosis, all objects frequently appear indistinct, but double. (*Visus duplicatus*; *Diplopia*.) It is remarked by Schmucker, that, in the *gutta serena*, which comes on gradually, the patient sometimes sees double, with both eyes. Some years ago, Schmucker cured a major of huzzars, who saw the three lines of his squadron double; and the same surgeon was ordered by the king of Prussia to attend a gentleman, who was afflicted in a similar way. In the opinion of this eminent surgeon, such cases are brought on by a violent distention of the vessels of the choroides, where he thinks, that varices may easily arise, in consequence of the weak resistance of that membrane. In this manner, the filaments of the retina suffer pressure, and the rays of light are broken. Under these circumstances, if prompt assistance be not afforded, total and frequently incurable blindness may be the consequence. Schmucker met with an example of such an irremediable amaurosis (the only instance in his practice,) in a young man, twenty-six years of age. When the patient made application for the advice of the foregoing surgeon, he had been blind a year. Before he lost his sight, he remarked, that, after any violent emotion, his sight at first grew weak, and that objects afterwards appeared double. When his circulation was at all hurried, he saw black spots before his eyes, and at length was quite blind. The vessels of the choroides were as large, as if they had been injected with wax, and every kind of surgical assistance proved ineffectual. (*Vermischte Chir. Schriften*, B. 2, p. 12, &c. 8vo. Berlin, 1786.) In some cases, according to Beer, double vision only occurs, when the patient looks at objects with both eyes, and it ceases as soon as he shuts either the diseased or the sound eye. In the last of these circumstances the double vision only originates from the deviation of the unsound eye from the axis of vision; but in the first instance, it arises from the morbid state of the retina itself of the diseased eye. For the purpose of distinguishing both these examples of diplopia from every other species of symptomatic double vision, Beer applies to them the name of *diplopia nervosa*. A degree of squinting, *strabismus*, therefore, is a very common symptom of incipient amaurosis, particularly when only one eye is affected: for, this always deviates more or less from the axis of vision. It is less usual for imperfect amaurosis to be accompanied with what Beer terms obliquity of the eye, (*Lusitas*;) either a paralysis of one or other of the muscles of the eye, or a ceaseless, irregu-

lar action of one or more of the same muscles, being evidently a condition of this symptomatic appearance. (See Beer's *Lehre von den Augenkrankheiten*, B. 2, p. 427.)

Beer has often met with patients labouring under imperfect amaurosis, who could plainly distinguish all objects, which were not very small; but saw them of a different colour from their real one; for instance, yellow, green, purple, &c. (*Visus coloratus; crupsia.*) He had under his care an amaurotic woman, who at midday could discern even the smallest objects in a strong light; but, they all appeared yellow, though no marks of jaundice were perceptible.

Sometimes, in the early stage of amaurosis, all objects appear quite distorted, bent, shortened, and, in rarer instances, inverted. (*Visus defiguratus; Metamorphosia.*) Thus the flame of a candle appears very long, but all awry. This is constantly an unfavourable omen, as the cause of it lies in the brain itself.

Imperfect amaurosis is sometimes attended with considerable shortsightedness (*Myopia*;) and sometimes with the opposite affection (*Presbyopia*;) an infallible proof that essential changes have happened either in the transparent media or in the muscles of the eye.

Many patients, when first attacked with amaurosis, every where testify a partiality to a great quantity of light, employing several candles at night, and sitting the day-time with their backs against a sunshiny window, in order to let whatever they are reading have a very strong light upon it. This symptomatic appearance of incipient amaurosis is termed by Beer, *Lichtthunger*.

Amaurosis may either take place in an instant, even so as to be attended with entire blindness; or it may come on quickly, that is, it may be complete in a few days or weeks; or, lastly, what is most frequently the case, it may be produced gradually, and several years elapse before it attains its utmost degree; circumstances of great moment in the diagnosis and treatment.

The type, which the disease assumes in its course and development, is also subject to great variety, and claims the utmost attention; for, amaurosis may either be permanent, or temporary. The gutta serena is sometimes an intermittent disorder, making its appearance at regular or irregular intervals. In certain examples, as Richter remarks, the disease prevails at particular times, commonly all day, till a certain hour; or from one day till the next; or at a stated time every month. The attacks of the complaint sometimes take place at indeterminate periods. In particular cases, another morbid affection is associated with the impairment of sight. Richter mentions a man, who became blind at twelve o'clock in the day, when the upper eyelid used also to hang down; in consequence of being affected with paralysis. The attack always lasted twenty-four hours. On the following day, at twelve o'clock, the sight used

to return, and the patient then suddenly regained the power of raising the upper eyelid. He would continue thus able to see for the space of the next twenty-four hours. Whenever he took bark, the disease was regularly doubled; that is to say, the man then alternately remained blind forty-eight hours, and recovered the power of seeing for only twenty-four. In another patient, cited by this experienced surgical writer, the aqueous humour, during the blindness, always became discoloured, whitish, and turbid; but its transparency regularly returned on the cessation of the attack. According to Richter, the periodical amaurosis commonly depends upon irritation affecting the digestive organs, the stimulus of worms, or irregularity in the menstrual discharge. Sometimes, it is plainly a symptom of a confirmed ague, the patient being attacked with an ordinary intermittent, and blind during each paroxysm, but always regaining his sight as soon as each fit is over. (See Richter's *Anfangsgr. der Wundarzn.* B. 3, Kap. 14.) Beer believes, however, that the periodical gutta serena is chiefly observed in chlorotic, hemorrhoidal, hysterical, and hypochondriacal subjects. Dayblindness (*Cæcitas Diurna; Nyctalopia*;) and nightblindness (*Cæcitas Crepuscularis; Hemeralopia*;) are nothing more than cases of periodical amaurosis. But sometimes the frequently recurring form of the disease confines itself to no determinate type; and, on account of its irregularity, it is then termed by Beer, *Amaurosis Vaga*, which he says is often of spasmodic origin, and therefore principally met with in persons liable to hysteria, hypochondriasis, convulsions, or epilepsy. Periodical amaurosis, after remaining uncured a certain time, often becomes permanent. (Beer, *Lehre*, &c. B. 2, p. 429.)

In amaurosis in general, but particularly when no material knowledge can be acquired of causes, and the treatment must of necessity be conducted on empirical principles, it is of the highest importance to recollect what Richter has pointed out, namely, that amaurosis sometimes commences with several symptoms, which seem to betray an increase of sensibility in the eye, or some irritation affecting this organ. In moderately light places, the patient can discern things very well; but, in a great light, he is not able to see at all. The eye is sometimes so sensible, that a strong light will make it weep and become painful. Patients of this description ought always to wear a shade, however bad their sight may be. Sometimes the gutta serena originates with symptoms of weakness and diminished irritability. The sight is cloudy, and the patient finds that he can see better in a light than a dark situation. He feels as if some dirt, or dust, were upon his eyes, and is in the habit of frequently wiping them. His power of vision is greater after meals than at the time of fasting. His sight is always, for a short time, plainer, after the external use of tonic remedies,

such as hartshorn, cold water, &c. Richter informs us of a person, who was nearly quite blind, but was constantly able to see very well, for the space of an hour, after drinking champaign wine. He also mentions a woman entirely bereft of sight, who was in the habit of having it restored again, for half an hour, whenever she walked a quick pace up and down her garden. This author likewise acquaints us with the case of a lady, who had been blind for years; but, experienced a short recovery of her sight, on having a tooth extracted. (*Anfangsgr. &c. B. 3. Kap. 14.*)

When the disorder is accompanied with a diminished sensibility in the eye in general, Professor Beer joins Richter, with respect to the temporary improvement of the sight after a nourishing meal, or drinking spirituous liquors; or when the patient's mind is elated with joy, or anger, though such melioration of sight, it is true, is but of very short duration.

On the other hand, it may be remarked, that every thing, which tends to depress the passions and spirits, augments the imperfection of sight. Where marks of increased sensibility prevail, the above-mentioned circumstances exercise a transient disadvantageous operation; the patient carefully retires from every strong light, and frequently shelters his eye with his hand, &c. (*Lehre von den Augenkr. B. 2, p. 430.*)

Amaurosis either presents itself as a genuine uncomplicated affection, or, at least, with the appearance of such a form of disease of the eye, depending solely upon a morbid state of the optic nerve, and cognizable by a diminution, or complete abolition, of the power of vision; or the disease is coexistent with other diseased appearances either in the eye, its vicinity, or some other organs at a distance from the eye, or in the general constitution. These appearances merit the most earnest consideration, because they are for the most part connected with the cause of amaurosis. According to this statement, then, there is a *genuine local amaurosis*, and a *complicated amaurosis*, which last may be either *local*, or *general*, or of both descriptions together, and therefore named by Beer, *perfectly complicated*. (*Vol. cit. p. 431.*)

On the whole, genuine local amaurosis, that is to say, a diminution or total loss of the eyesight, unattended with any other apparent local or constitutional defect, may be said to be a very rare case, the disorder being usually more or less complicated.

To the hitherto ascertained local complications, says Beer, belong the cataract; glaucoma; a general varicose state of the eyeball (*circsophthalmia*;) exophthalmia; atrophy of the eye; spasms in the organ and surrounding parts; paralysis of one or more muscles of the eye (*ophthalmoplegia*;) paralysis of the eyelids; ophthalmia in general, and internal ophthalmia in particular; a scorbutic blood-shot appearance of the eye; (*Hypoema Scorbuticum*;) and, finally,

wounds or contusions of the eye or adjacent parts. From this simple enumeration of local complications, one may see how frequently, under such circumstances, amaurosis is only a symptomatic effect of another disorder of the eye, with which it is conjoined, and how often it is connected with the same common causes, which pertain to another or several other diseases of the eye, as for instance, in gouty subjects, with glaucoma, cataract, circsophthalmia, &c.

Among the general complications, Beer enumerates those which are purely nervous; impairment of the health in various forms by infection, contagion, or miasmata; a bad habit of body; typhoid fevers; asthma; internal and external hydrocephalus; organic defects of the abdominal viscera; worms; chlorosis; consumption; old ulcers of the legs; organic disease of the brain and skull; complaints arising from pregnancy; hemorrhage, &c. In these general complications, Beer remarks that the casual connexion between amaurosis, and some other remote disease of another organ, or of the whole constitution, cannot be mistaken; and, says the same author, in these cases, we often see the disease of some other distant part from the eye, suddenly or gradually diminish, and immediately appear again as a sympathetic action in the form of amaurosis, of which the most remarkable instance is seen after the sudden healing of old ulcers of the legs. (*Beer, Lehre von den Augenkr. B. 2, p. 433.*)

From the above general remarks upon amaurosis, it is quite manifest, that the objective and subjective symptoms of the disease vary considerably according to the violence of its causes, and of the local and general complications, though the seat of the disease, and what is particularly the proximate cause of the loss of vision, be in the optic nerve; and it depends especially on the nature of the causes, whether this or that morbid appearance take place in the eye.

One may consider as the only real inseparable subjective symptom of amaurosis, that weakness of sight, (*Amblyopia*) or that complete blindness, in which neither with the unassisted nor assisted eye the least defect can be perceived in the structure and shape of the affected organ. Hence, Beer names such impairment of vision, or blindness, *amaurotic*. But how seldom this subjective symptom of amaurosis exists alone, and how frequently it is obscured by some other defect in the structure and form of the eye, is proved by daily experience.

The objective symptoms of amaurosis have hitherto been set down as merely consisting of a considerable dilatation of the pupil, and immobility of the iris, because these appearances are indeed the most frequent; but, as Beer observes, this is another proof what ignorance has prevailed respecting the true nature of that disease of the eye, and its modifications, which are usually termed amaurosis; the objective symptoms of the complaint being, accord-

ing to the nature of the causes, as numerous as the subjective.

First; the objective symptoms of amaurosis may consist in the faulty size and shape of the pupil. In many cases, the pupil is very much dilated, immoveable, and possesses its natural black colour, and usual transparency. It cannot be denied, that this is the state of numerous cases; but, it is equally true, that there are many exceptions. Sometimes, according to Richter, in the most complete and incurable cases, the pupil is of its proper size, and even capable of very free motion (*Tarbes, Recueil Periodique, &c. T. 2, p. 319*;) and, occasionally, it is actually smaller, and more contracted, than natural. This aperture often continues extraordinarily large in the strongest light; but in some instances it is unusually small in every kind of light. (*Arrachard, Recueil Period. &c. T. 1, p. 273*.—*Richter, Anfangsgr. &c. B. 3, p. 424*; *Beer, Lehre, &c. B. 2, p. 435*.) According to the latter writer, the pupillary edge of the iris rarely has its primitive shape, being generally more or less angular; either at some indeterminate point; or above and below, so as to resemble in some measure the pupil of the cat-race; or towards the nose, or temple, so as to have some similitude in its form to the pupil of ruminating animals. These appearances are highly important, having great influence over the diagnosis.

Frequently not only the size and shape of the pupil are faulty, but the position of that opening is quite unnatural, being inclined either upwards or downwards, or outwards or inwards; but most commonly in a diagonal line between inwards and upwards, and, in these cases, the pupillary margin of the iris never describes a regular circle, but is always more or less angular. (*Beer, Vol. cit. p. 436*.)

The pupil of an eye affected with amaurosis (as Richter remarks) seldom exhibits the clear shining blackness, which is seen in a healthy eye. In general it is of a dull, glassy, hornlike blackness, which symptom alone is frequently enough to apprise a well-informed practitioner of the nature of the disease. Sometimes the colour of the pupil has an inclination to green; while, in other examples, this aperture seems to be dense, white, and cloudy, so that the complaint might easily be mistaken for the beginning of a cataract. This error, into which inexperienced surgeons are liable to fall, may readily be avoided by attention to the following circumstances. The misty appearance is not situated close behind the pupil, in the place of the crystalline lens; but, frequently, is manifestly deeper in the eye. Nor is it in proportion to the impairment of sight, the patient being quite blind, while the misty appearance is so trivial, that, if it arose from the opacity of the crystalline lens, it could at most only occasion a slight weakness and obscurity of vision. At the same time, Richter acknowledges, that it must be more difficult to

avoid mistake, when a beginning amaurosis is accompanied with this cloudiness in the eye, and, consequently, when the degree of blindness seems to bear some proportion to the degree of mistiness in the pupil. However, in this case, if we are to credit Richter, the true nature of the disease may generally be known by comparing the ordinary symptoms of the two diseases. (*Anfangsgr. B. 3, p. 14*.) And, according to Professor Beer, when the pupil is of a true dark gray, or greenish gray colour, a lateral inspection of the eye will show plainly enough, that the cloudiness is in the vitreous humour, or behind it. Sometimes, the pupil appears reddish, quite red, or of a yellowish white colour; (*Lehre von den Augenkr. B. 2, p. 436*.) while in other cases, the interior of the eye, a good way behind the pupil, seems quite white, and a concave light coloured surface may be observed, upon which the ramifications of blood-vessels can be plainly seen. In particular instances, this white surface extends over the whole back part of the eye; while, in other cases, it only occupies a half or a small portion of it. This peculiar appearance has been ascribed to a loss of transparency in the retina itself, and a consequent reflection of the rays of light. (*Haller, Element. Physiol. Tom. 5, p. 409*.)

There can now be no doubt, that such whiteness behind the pupil must sometimes have originated from the diseased mass, which, in cases of fungus hæmatodes of the eye, grows from the deeper part of this organ, and gradually makes its way forward to the iris, being always attended with total loss of sight. Putting out of present consideration the change of colour within the eye, produced by fungus hæmatodes, the other palish changes behind the pupil are not confined, as Kieser supposes, to very old cases of amaurosis, because the alteration is described by Schmucker as taking place especially in examples, the formation of which has been quite sudden; (*Vermischte Chir. Schrift. B. 2*.) and Langenbeck has recorded cases, in which the same appearance happened in the early stage of the disease. (*Neue Bibl. B. 1, p. 64, &c.*)

Besides the above appearances in the pupil itself, and in the pupillary margin of the iris, Beer adverts to several important phenomena, with respect to the motion of the iris. Sometimes the iris moves but very inertly, and frequently not at all, though the light be strong, and the upper eyelid be rubbed over the eyeball. While, in other examples, a very moderate light will bring on such a rapid contraction of the iris and closure of the pupil, as are never witnessed in a healthy eye.

We have also the authority of Richter for asserting, that, in particular instances, the iris not only possesses a power of motion, but is capable of moving with uncommon activity, so that, in a very moderate light, it will contract in an unusual degree, and nearly close the pupil. (*Anfangsgr. der Wundarzn. B. 3, p. 424, Edit. 1795*.)

Two or three remarkable instances of the

active state of the iris, in cases of amaurosis, were some years ago shown to me by Mr. Albert, then staff surgeon of the York Hospital, Chelsea, and I have seen some other similar cases in St. Bartholomew's Hospital. Most of the patients in question had not the least power of distinguishing the difference between total darkness and the vivid light of the sun, or a candle placed just before their eyes. Janin and Richter have likewise seen the pupil capable of motion in this disease, and Schmucker has twice seen the same fact.

In some anomalous cases, when the strength of the light is suddenly increased, the pupil expands with more or less celerity.

I have already adverted to the occasional moveableness of the iris, notwithstanding the insensible state of the retina. Let me next take notice of a case which sometimes presents itself, and is quite the reverse of this last. The nerves of the iris may be paralytic, while those of sight continue unimpaired. Schmucker tells us, he was acquainted with a woman, whose pupil was uncommonly distended, and totally incapable of motion. Her sight was very weak, and spectacles were of no use to her. She could scarcely discern any thing by day, or in a strong light; but she could see rather better at night and in dark places. This infirmity of sight depended upon the dilated paralytic state of the pupil, by which too many rays of light were admitted into the eye; and the reason why the patient could see better at night was, because the pupil, in its natural state, always becomes widened and dilated in a dark situation. (See *Vermischte Chirurgische Schriften*, Von J. L. Schmucker, Band 2, p. 13, 14.)

Frequently, in amaurosis, when the sight of only one eye is lost, and the other retains its full power of vision, not the slightest defect can be discovered, as long as the patient keeps both eyes open; but the instant the sound eye is completely covered, the iris becomes perfectly motionless, its pupillary margin assumes an angular shape, and the pupil expands, being sometimes evidently drawn towards the edge of the cornea. (Beer, *Lehre von den Augenkrank.* B. 2. p. 438.)

Besides the above appearances of the pupil and iris, amaurosis is attended with other characteristic phenomena, which occur under certain circumstances, in the form, texture, and state of other parts of the eye, and adjoining organs. Thus, the patient often complains of a peculiar troublesome dryness of the eye, or of a sensation as if the eyeball were about to be pressed out of its socket; and, indeed, says Beer, one may sometimes hear a grating noise, and distinguish a fluctuation in the orbit behind the eye-ball, when this organ is pressed upon by the finger, or moved in various directions, though neither its circumference be enlarged, nor any tendency to exophthalmia be really present. Nor is it very uncommon to find the affected eye

preternaturally hard, soft, or even quite flaccid; but it is less common to find the dimensions of the globe of the eye increased, or the organ affected with atrophy. (Beer, *Vol. cit.* p. 438.)

The principal subjective morbid effects, which appertain to amaurosis, have been already described in speaking of the several defects of vision, which accompany an amaurotic weakness of sight. Besides these, however, there are other subjective symptoms, which merit attention. For instance, the patient feels in the eye and surrounding parts an irksome sensation, without any actual pain, and complains of a remarkable sense of fulness, or weight in the organ. Amaurotic patients are also frequently attacked with sudden violent giddiness, which usually ends in a considerable diminution of the eyesight, and sometimes in severe general headach. Occasionally they fancy that small atoms of dust are lodged under the eyelids, and are fearful of moving either these parts or the eye. It is also well known, that many persons become amaurotic, while labouring under severe hemicrania, which either extend from or to the diseased eye; while, on other occasions, the most violent pains are confined particularly to the region of the eyebrow, and have the appearance of being strictly periodical. In certain other cases, the pain is wandering, and shoots in every direction about the eyebrow. These painful feelings often precede the amaurotic blindness a considerable time, and often first take place when one or both eyes are already blind; but the pains and loss of sight are not unfrequently produced together. Lastly, some patients are met with, in whom the worst pains only last until the amaurosis is perfectly formed, when they gradually and permanently cease. In all these painful cases of amaurosis, the pain and the blindness chiefly depend upon the same cause, and one is seldom the occasion of the other. Sometimes amaurotic patients experience such violent pain, that they lose their senses, and grow delirious; but in these cases, if we can credit the assertion of Beer, important morbid changes in the bones of the skull, or the brain itself, are invariably noticed after death. (See *Lehre von den Augenkr.* B. 2, p. 439.) In some amaurotic patients, lethargic symptoms may be remarked; in others restlessness; and, more rarely, delirium in all its degrees, either as a transient or permanent affection.

Paralytic appearances may precede amaurosis, either in the vicinity of the eye, or in the muscles of the face, or in a distant situation, as the extremities. Sometimes they accompany the disease, and sometimes closely follow the amaurotic amblyopia; such a case of amaurosis being not unfrequently the forerunner of a fatal attack of apoplexy.

In the same way convulsive symptoms may be conjoined with amaurosis, and when they first occur in the complete stage

of the latter disease. Beer pronounces them a very unfavourable omen for the patient's life.

But, according to the same experienced oculist, when in a case of perfect amaurosis, several of the other external senses are affected; and lastly, when the internal senses begin to suffer, when, for instance, the hearing, and then the smell, and taste are lost, and afterwards the memory and other intellectual powers fail, the patient's speedy dissolution may be expected. (See *Lehre, von den Augenkrankh. B. 2, p. 441, Wien, 1817.*)

As Professor Beer correctly observes, age cannot be considered a predisposing cause of amaurosis, as it is of a cataract; for there are many more blind persons who have been deprived of their sight by amaurosis in their best days, than of old persons thus attacked. Amaurosis spares no age, not even the new-born infant.

Neither does sex nor race appear to have any influence over the origin of the complaint; but it would seem that dark eyes, especially those which are called black, are more disposed to amaurotic blindness than such as are light coloured. According to Beer's experience, for every gray or blue eye affected with amaurosis, there are five and twenty or thirty brown or black ones, thus diseased. In the peculiar constitution of the eye, then, as well as in a sanguineous and choleric temperament, there exists a tendency to the disorder.

More frequently than cataract, amaurosis is found to be a true hereditary disease. This is so much the case, that most of the members of a family, for more than one generation, may lose their sight from amaurosis at a certain period of life. Beer says, that he is acquainted with more than one family in which this has happened; and, what merits attention, the women of one of these families, down to the third generation, became completely and permanently blind from amaurosis on the cessation of the menses, while all the others, who had had children, were unaffected. But the males of this unfortunate family, who, as well as the females, have very dark brown eyes, all seem to be weak-sighted, though none of them are yet blind. (*Lehre von den Augenkrankheiten, b. 2. p. 443.*)

In women, especially those with black eyes, the time when the menses stop is a dangerous period for the commencement of amaurosis, particularly that form of it which Beer chooses to denominate *gouty*.

According to the same writer, patients, whose piles used to bleed periodically for a long time, but are now suddenly stopped, and whose eyes are dark, are often attacked with amaurosis.

One of the less common causes of amaurosis is an idiosyncrasy in relation to this or that sort of nutriment or medicine; or this or that particular state of the body. Here is to be reckoned the amaurotic weakness of sight, or the perfect amaurosis, which

comes on at the very commencement of pregnancy, and subsides after delivery, but always attended with dyspepsia and insuperable vomiting. This species of amaurosis, however, should be carefully distinguished from that which sometimes first originates in the final months of pregnancy, and chiefly from strong and long-continued determination of blood to the head and eyes, particularly when the bowels are at the same time loaded, and the patient constipated. This latter case usually continues till after delivery; or, if the labour be tedious, difficult, and attended with considerable efforts, the blindness may first attain its complete form at the time of delivery, and not afterwards subside.

Beer saw a young Jewess, who at the very beginning of her first three pregnancies, which followed each other very quickly, regularly used to lose her sight, becoming completely amaurotic between the third and fourth months; and, on the two first occasions, she continued blind till after delivery; but, in the third instance, the power of vision never returned at all. Beer twice had under his care another woman, who was attacked with amaurosis whenever she drank chocolate; but, upon leaving off that drink, she never afterwards had any complaint in her eyes.

If we are to believe Professor Beer, the abuse of bitter substances, as of chicory in coffee, bitter malt liquors, and bitter medicines, especially quasia, is unquestionably a predisposing cause of amaurosis.

The abuse of narcotic poisonous substances may induce amaurosis; immoderate doses of opium, hyoscyamus, belladonna, &c. Lead will do the same thing. Beer mentions a case in which the only assignable cause was the exhibition of pills, containing the extractum cynoglossi.

One not unfrequent and very important cause of amaurosis is hysteria and hypochondriasis, with which must be included infarction generally, and induration of one or more of the abdominal viscera, especially the liver. (*Beer, Lehre, &c. B. 2. p. 444-46.*)

According to Richter, the remote causes of gutta serena may be properly divided into three principal classes, the differences of which indicate three general methods of treatment.

It is alleged, that the first class of causes seem to depend upon an extraordinary plethora and turgidity of the blood-vessels of the brain, or of those of the optic nerves and retina, upon which last parts a degree of pressure is thereby supposed to be occasioned. A considerable plethora, especially when the patient heats himself, or lets his head hang down, will frequently excite the appearance of black specks before the eyes, and sometimes complete blindness. A plethoric person (says Richter,) who held his breath, and looked at a white wall, was conscious of discerning a kind of network, which alternately appeared and disappeared with the diastole and systole of

the arteries. This phenomenon, it is conjectured, originated from the plethoric state of the vessels of the retina. Boerhaave mentions a man, who always lost his sight on getting tipsy, and regained it on becoming sober.

Richter thinks it likely, that it is in this manner that the disease is produced, by the suppression of some habitual discharge of blood, by not being bled according to custom, by the stoppage of the menses, and by the cessation of hemorrhage from piles; circumstances, which, if we can give credit to all the accounts of Richter, Scarpa, Schmucker, and other experienced writers on the subject, frequently give rise to gutta serena. In the same manner, the complaint may be brought on by great bodily exertions, which must determine a more rapid current of blood to the head. Richter informs us of a man who became blind all on a sudden, while carrying a heavy burden up stairs. He tells us of another man, who laboured excessively hard for three days in succession, exerting his strength very much, and who became blind at the end of the third day. Pregnant women, in like manner, are sometimes bereft of their sight during the time of labour. Schmucker has recorded a remarkable instance of this in a strong young woman, thirty years old, and of a full habit. Whenever she was pregnant, she was troubled with violent sickness till the time of delivery, so that nothing would stop in her stomach. She was bled three or four times without effect. Towards the ninth month her sight grew weak, and for eight or ten days before parturition she was quite blind. The pupil of the eye was greatly enlarged, but retained its shining black appearance. She recovered her sight immediately after delivery, and did not suffer any particular complaints. Schmucker assures us, that he has been three times a witness of this extraordinary circumstance. (*Vermischte Chir. Schriften*, Band 2, p. 6, edit. 1786.) Richter speaks of a person who lost his sight during a violent fit of vomiting. Schmucker acquaints us, that it is not uncommon for soldiers, who are performing forced marches in hot weather, to become blind all on a sudden. All great exertions of strength, when the body is plethoric, or heated, or bent forwards with the head in a low posture, are usually attended with some danger of bringing on amaurosis.

The blindness which follows external injuries of the head, is ranked by Richter among the preceding class of cases. A man who received a smart box on the ear, says this author, lost his sight on the spot. Richter conceives it probable, that a concussion of the head may sometimes produce an atony of the blood-vessels, giving rise to their dilatation, and consequent pressure on the adjacent nerves: perhaps, it is more likely, that the blow itself actually ruptures them, and produces an effusion of blood. Richter suspects that the gutta serena,

which originates during a violent ophthalmia, or during a severe inflammatory fever, may be of the same nature. He thinks it probable, that persons, who become blind while exposing themselves to the burning sun, with their heads uncovered, have their sight impaired in a similar way.

Beer also coincides with Schmucker, Richter, and others, in regarding as a frequent cause of amaurosis, repeated and long continued determinations of blood to the head and eyes, produced by various circumstances,—viz. by pregnancy; a tedious and difficult labour; lifting and carrying heavy burdens, especially with the arms raised up; all kinds of work in which the eyesight and intellectual faculties are intensely exerted, with the head bent forwards, and the abdomen compressed, as is the case with shoemakers, tailors, &c.; every sudden stoppage of natural or preternatural long established discharges of blood, as that of the menses, lochia, or hemorrhoids; the omission of an habitual venesection at some particular season of the year; severe and obstinate vomiting; forced marches in hot dry weather; scrofulous and other swellings of considerable size in the neck, pressing upon the jugular veins, and obstructing the return of blood from the head; the use of a pediluvium, or warm bath, the water of which is of high temperature; hard drinking; violent gusts of passion; frequent and obstinate constipation; and hard straining at stool. These causes are more likely to occasion amaurosis, in proportion as the individual is young and plethoric. (*Beer Lehre von den Augenkr. B. 2. p. 446.*)

The second class of causes are supposed to operate, by weakening either the whole body, or the eye alone, and they indicate the general or topical use of tonic remedies. In the first case, the gutta serena appears as a symptom of considerable universal debility of the whole system; in the second case, the disease is altogether local. Every great general weakness of body, let it proceed from any cause whatsoever, may be followed by a loss of sight. The gutta serena, if we can give credit to the statement of Richter, has sometimes been the consequence of a tedious diarrhœa, a violent cholera morbus, profuse hemorrhage, and immoderate salivations. He informs us of a dropsical woman, who became blind on the water being let out of her abdomen. According to the same author, no general weakening causes operate upon the eyes, and occasion total blindness so powerfully and often, as premature and excessive indulgence in venereal pleasures.

The causes are various which operate locally in weakening the eyes. Nothing has a greater tendency to debilitate these organs than keeping them fixed very attentively, for a long while, upon minute objects. But, however long and assiduously objects are viewed, if they are diversified, the eye suffers much less than when they

are all of the same kind. A frequent change in the objects which we look at has a material effect in strengthening and refreshing the eye. The sight is particularly injured by looking at objects with only one eye at a time, as is done with telescopes and magnifying glasses; for when one eye remains shut the pupil of that which is open always becomes dilated beyond its natural diameter, and lets an extraordinary quantity of light into the organ. The eye is generally very much hurt, by being employed in the close inspection of brilliant, light-coloured, shining objects. They are greatly mistaken, says Richter, who think that they save their eyes when they illuminate the object which they wish to see, in the evening, with more lights, or with a lamp that intercepts and collects all the rays of light, and reflects them upon the body which is to be looked at. Richter makes mention of a man, who, in the middle of winter, went a journey on horseback, through a snowy country, while the sun was shining quite bright, and who was attacked with amaurosis. He speaks of another person, who lost his sight, in consequence of the chamber in which he lay being suddenly illuminated by a vivid flash of lightning. A man was one night seized with blindness, while he had his eyes fixed on the moon in a fit of contemplation. Richter also expresses his belief, that a concussion of the head, from external violence, may sometimes operate directly on the nerves, so as to weaken and render them completely paralytic.

Professor Beer corroborates the foregoing statement; for, he says, among the most frequent causes is to be considered every abuse of the eyesight, especially in dark-eyed persons, as a long and close inspection of one object, particularly with a microscope, when the thing examined is very brilliant, or reflects back much light into the eye. Hence, the view of jewels at night, and long journeys through snowy countries, &c. are conducive to the disease. In this respect, every kind of employment which strains the eyes much, and requires a strong reflected light, must be considered injurious. Thus reverberating lamps, like Argand's; a white wall opposite the windows, and illuminated with the sun's rays, and looking a long while at the moon, or more especially the sun, with the unassisted eye, are circumstances likely to bring on the disease. That a flash of lightning, especially when it suddenly wakes a person in the night-time out of a sound sleep, may produce an amaurotic amblyopia in an irritable eye, or even perfect blindness, is a well-known fact; and, it is on the same principle, that going suddenly out of a dark bed-room immediately after waking in the morning into an apartment that commands an open extensive prospect, must be hurtful to an irritable eye, though the bad effects may only be very slow. Here is also to be included every kind of over irritation of the eye by light, as happens to typhoid pa-

tients, when they lie with their eyes open all the day in a large sunny chamber.

Very often the cause of amaurosis consists in local or constitutional debility, proceeding from impairment of the nerves in general, or of the nerves of the head, especially those of the forehead and eyebrow; either from a concussion of the spinal marrow, falls from a considerable height with the weight of the whole body upon the heels; concussions of the eye-ball, sometimes caused by violent artificially excited sneezing, but more generally by contusions of the eye with blunt weapons, &c. If we are to believe Beer, and other foreign practitioners, considerable direct weakness may arise from cholera, long-continued diarrhoea, salivation, and the incessant spitting of tobacco-smokers; bleedings; injudicious tapping of the abdomen; excessive indulgence in venery, and the misemployment of issues. A general debility, which has the worst effect on the eyes, may also arise from long trouble; tedious vexation, and worldly cares, especially when the diet is poor and bad; also from a deficiency of proper food; long watching; violent and sudden fright; imprudently washing the eyes with very cold water, especially when they are already weakish and irritable; and keeping them long in a dark place, particularly when they are also exerted a good deal in some particular kinds of labour, a case which Beer says is very frequent in Vienna. The amaurosis, following typhus, without any unusual irritation of the eye by light. Beer also refers to general debility. (*Lehre von den Augenkr. B. 2. p. 449.*)

The third class of causes consists of irritations, which in some inexplicable way affect the optic nerves, and render them insensible of the impression of the light. Most of these irritations are asserted to lie in the abdominal viscera, whence they sympathetically operate upon the eyes. The observations of Richter, Scarpa, and Schmucker, all tend to confirm, that amaurosis more frequently arises from irritation in the gastric organs than any other cause whatever. It may often be ascertained, that patients with amaurosis have suffered much trouble, and long grief, or been agitated with repeated vexations, anger, and other passions, which are supposed to have a great effect in disordering the bilious secretion, and the digestive functions in general. Richter tells us of a man, who lost his sight a few hours after being in a violent passion, and recovered it again the next day, upon taking an emetic, by which a considerable quantity of bile was evacuated. A woman is also cited, who became blind whenever she was troubled with what are termed acidities in the stomach. (*See Anfangs. der Wundaren. B. 3, Kap. 14.*) However, according to Beer, the imperfect amaurosis seldom depends upon disorder of the gastric organs, excepting the case from worms: (*Lehre von den Augenkr. B. 2. p. 456.*) a very important difference of opi-

nion from that entertained by Schmucker, Richter, and Scarpa.

The continental surgeons are excessively comprehensive in their ideas of the causes of gutta serena, and, with many truths, they blend an evident quantity of unestablished conjectures, and palpable absurdities. I believe, it will generally be found, that, when surgical writers assign a multitude of causes for any disease, they deal very much in mere supposition. It would be idle credulity, indeed, to put faith in the assertions concerning amaurosis being occasioned by the bad treatment of particular fevers, suppressed diarrhoeas, the repulsion of eruptive complaints, &c. There is no reason why a person should not become blind about the time when another disorder gives way; but we ought to have some other ground for the doctrines, to which allusion is made, before we can presume to offer them as entitled to confidence. These observations apply to some of the causes of amaurosis enumerated by Beer, of whose sentiments I mean presently to give a full account.

Worms in the alimentary canal are alleged to be sometimes the cause of amaurosis; and, since a disordered state of the gastric organs is universally acknowledged to be frequently concerned in the production of blindness, we can have no difficulty in conceiving that worms may likewise have the same effect. Besides gastric irritations, there are some others which class as causes of this disease. A violent fright, which is considered as being a frequent remote cause of gutta serena, is supposed by Richter to operate chiefly by irritating the nerves.

The blindness sometimes proceeds from a mechanical kind of irritation. A man received in his right orbit a small shot, which pierced the upper eyelid, and lodged at the upper part of the socket, between the eyelid and eyeball, so that it could be felt externally. Richter adds, that this patient shortly afterwards became blind in the left eye; but recovered his sight in it again upon the excision of the shot. (*Anfangsgr. der Wundarzn. Band 3, p. 439.*)

Sometimes, says this experienced surgeon, the irritation, exciting amaurosis, seems to have its seat in the mucuous membrane of the nose and frontal sinuses. We have already adverted to the unusually dry state of the nostril, that has been suspected of being occasionally conducive to this species of blindness.

According to Beer, several constitutional disorders, but more especially gout, are frequently concerned in the production of amaurosis.

Respecting the causes of amaurosis, the following remarks by Beer claim attention. Various swellings in the orbit, as, for instance, encysted tumours, tophi, hydatids in the sheath of the optic nerve, may, and must gradually produce complete amaurosis by their pressure upon the optic nerves and retina. These cases are usually

characterized by a protrusion of the eye from its socket. (See *Exophthalmia*.)

In the same manner, different morbid changes in the brain itself, and in the bones of the cranium in particular, may be the direct cause of amaurosis: for example, hydrocephalus internus, caries, and exostoses at the basis of the skull.

Just as amaurosis is frequently a pure symptomatic effect of various disordered states of the constitution, so may different morbid changes, occasioned in the eye by those states of the health, become the proximate cause of amaurosis, as hydrophthalmia, cirsophthalmia, dissolution of the vitreous humour, glaucoma, &c.

From a contagious atmosphere, which is generally injurious to the eyes, an amaurotic blindness may originate, though but very rarely, and, as it would seem, only through the powerful influence of such state of the air over the whole sanguiferous and nervous system. Debilitated, nervous, weak-sighted persons, by remaining long in the atmosphere of a privy (*Chomel, Mém. de Paris, 1711, Obs. Anat. 5. and Ramazzini, De Morbis Artificum, c. 13.*) that of a deep cellar, or exposed to coal-smoke, may be suddenly attacked with amaurosis; and Beer assures us, that his experience confirms the truth of these reports. (*Lehre, &c. b. 2. p. 452.*) A sympathetic affection of the nerves of the eye, with a carious grinder in the upper jaw-bone, is one of the most uncommon causes of amaurotic blindness.

A case, not yet duly considered, and very like the amblyopia senilis, consists of an incessantly diminishing secretion of the pigmentum nigrum upon the tunica Ruyschiana, choroidea, and uvea, which secretion indeed, in some individuals, earlier and more considerably; in others, later and in a slighter degree, recedes with other secretions of a different nature. In consumptive persons, this change happens in a remarkable degree, so that the patients are gradually quite bereft of vision. (See *Beer's Lehre von den Augenkr. B. 2. p. 451, &c.*) For a variety of additional facts and observations respecting the causes of amaurosis, I would advise the reader to consult *Wardrop's Essays on the Morbid Anatomy of the Human Eye, vol. 2. chap. 45*; a work replete with valuable information.

It is remarked by professor Beer, that amaurosis, when completely formed, has hitherto been but rarely cured. This (says he) may depend, in the first place, upon our far too imperfect knowledge of the nerves, and of their genuine and complicated disorders. Secondly, it may equally depend upon the present very defective etiology of amaurosis. Thirdly, the frequent incurability of amaurosis also very materially proceeds from the causes of the disease being, in most instances, not only obscured, but exceedingly complicated; and even when detected, many of them will not admit of removal, because they have their foundation either in the constitution

of the eye, long existing defects of physical and moral education, protracted bad habits of youth, or the unmanageable behaviour of the patient. Fourthly, we must take into the account the unconscious indolence of the practitioner, who so often positively declines rendering the patient any assistance at all; or, if for the sake of lucre he attempt any thing, it is only an empirical mode of treatment, by which means every chance of benefit is annihilated, while an active and intelligent surgeon might perhaps preserve vision, and bring it to perfection again.

When there is a probability of relieving amaurosis, the cure is mostly tedious, and beset with many difficulties, though the blindness has originated and formed suddenly, the utmost attention, and the greatest practical skill, being requisite on the part of the surgeon. Hence, as Beer observes, even in favourable cases, either the patient himself, the surgeon, or both of them, lose all inclination to persevere in the treatment, and the unfortunate victim is either left to his fate, or consigned to impudent, mercenary quacks.

In amaurosis, the difficulty of cure is naturally in proportion to the variety and number of causes of the complaint; and the more readily the surgeon makes himself acquainted with them, and the more certainly he obviates them, the more surely and quickly does the cure follow.

It may be considered as generally true, that every amaurotic weakness of sight, and every completely formed amaurosis, are attended with the greatest probability of cure, where they began suddenly, and were quickly developed; for experience proves, that, in these cases, the whole of the causes of the disease are much more frequently and earlier comprehended than when the complaint has been several years in forming. —(Beer, *Lehre von den Augenkr.* b. 2. p. 454 —56.) This observation perfectly coincides with the account given by Schmucker, who says, that many of these suddenly formed cases have fallen under his notice, and been more easy of cure, than when the disorder had come on in a more gradual way. (See *Vermischte Chir. Schriften*, b. 2.)

A case may happen, nay, it happens not unfrequently, says professor Beer, (which, considering the imperfect etiology of amaurosis, cannot be wondered at,) that the surgeon, after the most careful investigation, can absolutely detect no particular cause of the existing amaurotic blindness, in which event, the prognosis must in every respect be very uncertain and unfavourable, since only empirical treatment can be tried, which rarely answers; and, even when a cure in this manner does follow, it is frequently quite accidental.

As will be seen in the account of each particular species of amaurosis, the affected eye is sometimes so conditioned, that the complete incurability, sooner or later, may be prognosticated with entire certainty, and

this even though a degree of vision may now be enjoyed.

There are amaurotic patients, in whom every treatment does harm, the disease making uninterrupted advances to perpetual blindness. This observation especially refers to local remedies, of the danger of which, under certain circumstances, the patient should be carefully warned.

In general, the more complete the amaurosis is, and the longer the patient has been deprived not only of vision, but of all sensibility to light, the less hope is there of sight being ever re-established.

When one eye has been completely bereft of sight by amaurosis, and the surgeon can find out little or no cause for the infirmity, there is strong reason for apprehending that the other eye will sooner or later become blind. This is a fact amply proved by experience, and the exceptions are very rare.

According to Beer, the idea entertained by some writers is not built upon experience, that amaurotic patients, in whom the iris is still moveable, and the pupil not very much dilated, are more easily and frequently cured than others in whom the iris is perfectly motionless, and the pupil exceedingly dilated. For sometimes, during the treatment, or even spontaneously, the iris, after being quite immoveable, recovers its power of motion, yet the patient may not, at the same time, regain the slightest degree of vision; and on the other hand, many cases of perfect amaurosis are cured, without the iris recovering any of its mobility, and the pupil remains dilated during the remainder of the patient's life. (*Lehre von den Augenkr.* b. 2. p. 458.) Richter also thinks, that the moveable or immoveable state of the pupil can neither be considered as a favourable nor unfavourable circumstance. Sometimes, says he, an amaurosis may be cured, which is attended with a pupil extraordinarily dilated, and entirely motionless; and sometimes the disorder proves incurable, notwithstanding the pupil be of its proper size, and capable of motion. There are likewise examples, in which the pupil recovers its moveableness, in the course of the treatment, although nothing will succeed in restoring the eyesight. (*Anfangsgr. der Wundarzn.* b. 3. p. 424. 8vo. Golt. 1795.)

In some very rare instances, says Beer, amaurotic blindness has been cured by some apparently accidental, or indeed morbid effect, without any assistance from art; by hemorrhage from the nose, an intermittent fever, a blow on the head, &c. The same experienced writer operated successfully upon both eyes of a patient with cataracts, which had been previously depressed too far against the retina, so that their pressure gave rise to amaurosis, which, after continuing eight years, was suddenly removed by the patient's accidentally falling out of bed, and pitching upon the top of his head. (*Lehre von den Augenkr.* b. 2. p. 458.)

The following observations, made by professor Beer, respecting the prognosis, can-

not fail to prove interesting. There is a species of amaurosis, which gradually diminishes of itself; for instance, that which arises from hard drinking, or the effect of narcotic poisons, belladonna, opium, hyoscyamus, &c.

Sometimes imperfect amaurosis goes away, without any assistance from art, in consequence of the accession of some other disease, as an eruption, a discharge of matter from the ear, bleeding from piles, the menses, &c.

Also, in most cases, when the surgeon is so fortunate as to cure amaurosis, either by scientific or empirical methods, there still continues, for life, a considerable degree of amblyopia, more especially if the amaurosis has been complete.

Sometimes, by successful treatment, vision is in a great measure, or even entirely, restored in one eye; yet the other remains completely blind; or one eye sees again much sooner than its fellow, although they were both affected together with an equal degree of blindness.

It often happens that, though a material degree of vision returns in the course of the treatment, the faculty is restricted to a circumscribed point of the retina, so that the patient is enabled to see objects plainly only when they are held in a particular direction before him; while, in other directions, they are either quite invisible, or very indistinct. (Beer, *Lehre von den Augenkr.* b. 2. p. 459, 60.)

Professor Scarpa, of Pavia, has given an excellent account of the prognosis in cases of amaurosis. Some of his doctrines, however, founded on the humoral pathology, are hypothetical, and therefore purposely omitted in the following account. It also deserves notice, that the case supposed to originate from injury of the supraorbital nerve, is not always incurable. Scarpa only knows of one such cure, viz. the example recorded by Valsalva. (*Dissert.* 2. § 11.) But additional instances are reported by Hey (*Med. Obs. and Inq.* vol. 5.) by Larrey (*Mém. de Chir. Militaire*, t. 4. p. 181.), and Dr. Hennen (*Principles of Military Surgery*, p. 346. ed. 2.) According to Mr. Wardrop, it is only when this nerve is wounded, or injured, and not divided, that amaurosis takes place; for the blindness may sometimes be cured by making a complete division of the trunk nearest its origin. (*Essays on the Morbid Anatomy of the Human Eye*, vol. 2. p. 180.)

Amaurosis is divided by Scarpa into the perfect, or imperfect; inveterate, or recent; and continued, or periodical.

The perfect, inveterate amaurosis, attended with organic injury of the substance, constituting the immediate organ of sight, says Scarpa, is a disease absolutely incurable. The imperfect, recent amaurosis, particularly that which is periodical, is commonly curable; for it is mostly sympathetic with the state of the stomach and primæ viæ; or

dependent on causes which, though they affect the immediate organ of sight, are capable of being dispersed, without leaving any vestige of impaired organization in the optic nerve or retina.

When amaurosis has prevailed several years, in persons of advanced age, whose eyesight has been weak from their youth; when it has come on slowly, at first with a morbid irritability of the retina, and then with a gradual diminution of sense in this part, till total blindness was the consequence; when the pupil is motionless, not circular, and not much dilated; when it is widened in such a degree, that the iris seems as if it were wanting, and the margin of this opening is irregular and jagged; and, when the bottom of the eye, independently of any opacity of the crystalline lens, presents an unusual paleness, like that of horn, sometimes partaking of green, and reflected from the thickened retina, the disease may be generally set down as incurable. Kieser joins Scarpa in representing this alteration as an unfavourable omen, adding, that it only takes place in examples of long standing, and, that when it is considerable, the disease is incurable. Langenbeck differs, however, from both these authors, and particularly from Kieser, assuring us, not only that he has often seen this discolouration of the bottom of the eye in the early stage of amaurosis, but seen patients in this state soon cured. The cases which he has published, in proof of this statement, I have read with care, and find them completely satisfactory. Langenbeck agrees with other writers in imputing the appearance to a morbid change of the retina, and the treatment which he prescribes consists in the internal exhibition of the oxymercurate of mercury in small doses, and friction with mercurial ointment on the eyebrow and temple. (See *Langenbeck's Neue Bibl. für de Chirurgie*, 1 b. p. 64—69, &c. Göttingen, 1815.)

Cases, says Scarpa, may be deemed irremediable, which are attended with pain all over the head, and a continual sensation of tightness in the eyeball; which are preceded by a violent, protracted excitement of the nervous system, and then by general debility, and languor of the constitution, as after masturbation, premature venery, and hard drinking. There is no remedy for cases connected with epileptic fits, or frequent spasmodic hemichrania; nor for such as are the consequence of violent, long-continued, internal ophthalmia. Cases are incurable, also, when produced by violent concussions of the head, direct blows on the globe of the eye, or a violent contusion, or other injury of the supraorbital nerve, and this, whether the disease take place immediately after the blow, or some weeks subsequently to the healing of the wound of the eyebrow. Amaurosis is also incurable, when occasioned by foreign bodies in the eyeball, lues venerea, or exostoses about the orbit. Lastly, amaurosis is absolutely irremediable, when conjoined with a

manifest change in the figure and dimensions of the eyeball.

On the contrary, all cases of imperfect, recent amaurosis, whether the blindness be total or partial, are mostly curable, when not produced by causes, capable of contusing or destroying the organic structure of the optic nerve, and retina. This is especially true when the retina is in some degree sensible to the impression of light. Recent, sudden cases, in which the pupil is not excessively dilated, and its circle remains regular, while the bottom of the eye is of a deep black colour; cases, unaccompanied with any acute, continual pain in the head and eyebrow, or any sense of constriction in the globe of the eye itself; cases, which originate from violent anger, deep sorrow, fright, excessive fullness of the stomach, a foul state of this viscus, general plethora, or the same partial affection of the head, suppression of the menses, habitual bleedings from the nose, piles, &c. great loss of blood, nervous debility, not too inveterate, and in young subjects, are all, generally speaking, curable. Amaurosis is also, for the most part, remediable, when produced by convulsions, or the efforts of difficult parturition; when it arises during the course, or towards the termination of acute, or intermittent fevers; and when it is periodical, coming on at intervals, such as every day, every three days, every month, &c. (*Scarpa, Osservazioni sulle Malattie degli Occhi, cap. 20. Venez. 1802.*)

In general, when the treatment proves successful, the return of the power of vision is accompanied with a regression of the same characteristic effects, which were disclosed in the gradual advance of the disorder, viz. appearances as if there were before the eyes flashes of light, a cobweb, network, mist, or flaky substances. (*Beer, Lehre von den Augenkr. b. 2. p. 460. Wien. 1817.*)

Upon the commencement of the cure, there is also a return of the obliquity of sight; one of the most constant symptoms of imperfect amaurosis. This is a circumstance, which Mr. Hey took particular notice of in some cases, which fell under his observation many years ago: he says, that it was most remarkable in those persons who had totally lost the sight in either eye; for, in them, the most oblique rays of light seemed to make the first perceptible impression upon the retina; and, in proportion as that nervous coat regained its sensibility, the sight became more direct and natural. (*See Med. Obs. and Inq. vol. 5.*)

TREATMENT OF AMAUROSIS, OR GUTTA SERENA.

Where amaurosis is to be fundamentally cured, not upon empirical, but scientific principles, all the causes of the disorder must be ascertained, and, if possible removed, as in the treatment of every other complaint. How often, however, it is impossible to accomplish the one or other of

these objects, must be clear enough from the preceding observations, particularly those concerning the etiology of the disease; and hence it is not surprising that amaurosis should so frequently resist every endeavour to cure it.

The plan of treatment is to be regulated, first by the number and kinds of circumstances, which determine the form of the disorder; secondly, by its presence, degree, and duration. When only the chief causes can be ascertained, a scientific mode of treatment may always be instituted; though here it is very necessary to pay the utmost attention to those morbid effects in the constitution, and in the eye in particular, which appear to have no connexion with the causes of amaurosis, and merely exist as accidental cotemporary defects.

If no particular circumstances can be assigned as the cause of amaurosis, the surgeon has no alternative but the adoption of some empirical method of treatment; but, exclaims professor Beer, wo to the patient whose surgeon, under these circumstances, draws from a heap of what are considered remedies for amaurosis, as from a lottery, the first as the best!

In order to avoid this erroneous method; at all events, to do no harm, if no good be practicable; and not perhaps to render a half-blind person completely blind, instead of improving, or at least preserving, whatever remnant of vision there may be; the surgeon should act with great caution, and constantly bear in his mind, first, the constitution, sex, and age of the patient; secondly, his ordinary employments, and general mode of living; and, thirdly, the principal morbid appearances under which the amaurosis originated and was developed. (*Beer, Lehre von den Augenkr. b. 2. p. 462.*) But, what will be of the greatest assistance, is a correct acquaintance with the remedies for amaurosis in general, and the circumstances under which the use of this or that particular means is likely to be useful or detrimental. I know of no writer who has been so minute on this part of the subject as professor Beer, whose sentiments (be it also remarked) are here in many respects different from those of Richter and Scarpa; for, like the surgeons of this metropolis, he rarely employs the emetic plan of treatment, which, according to his principles, is not only ineffectual, but hurtful, whenever the blindness is attended with determination of blood to the head and eyes, plethora, an accelerated circulation, or (what is understood by) a phlogistic diathesis. Beer's opinions, respecting the employment of emetics, and other means for the cure of amaurosis, may be partly collected from the sequel of this article; but, more especially, from the fuller statement which will be made at a future opportunity. (*See Gutta Serena.*) In the mean time, I shall endeavour to offer a general account of the practice recommended by Schmucker, Richter, and Scarpa, according to the arrangement of causes adopted by

the second of these valuable writers, and already detailed in the foregoing pages; for I need not repeat that, whenever the method of cure can be directed against the causes of the disease, it is the most proper and scientific. The present article will, then, close with a description of the four forms into which Professor Beer divides amaurosis, and a history of their varieties, symptoms, and treatment, according to the doctrines and experience of this eminent oculist.

In that species of amaurosis, which arises from the first class of causes specified by Richter, namely, from those which seem to induce the disease, by means of a preternatural fulness and dilatation of the blood-vessels of the brain, or eye, the indication is evidently to lessen the quantity of blood, and diminish the determination of it to the head. For this purpose, the patient may be bled in the arm, temporal artery, or foot. This evacuation is to be repeated as often as seems necessary; and it will be better to begin with taking away from twelve to sixteen ounces. We are also advised by Schmucker to apply ten or twelve leeches to the neck and temples. The efficacy of bleeding, in the cure of particular cases of gutta serena, is strikingly exemplified by numerous well authenticated observations. Richter informs us of a woman, who, on leaving off having children, lost her sight; but recovered it again by being only once bled in the foot. A spontaneous hemorrhage from the nose also cured a young woman, who had been blind for several weeks. (*Anfangsgr. der Wundarzn. b. 3. p. 442.*)

General bleeding sometimes proves ineffectual, unless assisted by topical. Leeches may be applied to the temples, or cupping glasses to the back part of the neck. When the disorder is connected with chlorosis, or the cessation of bleeding from piles, leeches may be put on the perineum, the inside of the thigh, or the sacrum. Local bleeding, however, seldom avails, except the whole mass of blood has been previously diminished by the prudent employment of the lancet. Besides bleeding, the surgeon may advantageously have recourse to other means at the same time; as, for instance, emollient clysters, purgatives, blisters, bathing the feet in warm water, &c.

In some cases all the foregoing means fail in producing the desired benefit, even when they have been followed up, as far as the state of the pulse and strength of the constitution will allow. Here the continuance of the disease may depend, either upon the stoppage of some wonted evacuation of blood, or else upon some other cause of the first class. In the first of these cases (says Richter,) experience proves, that the disease will sometimes not give way before the accustomed discharge is re-established, on which the malady depends, notwithstanding evacuations may be employed in any way whatsoever. A woman, who (as this author acquaints us) had lost

her sight, in consequence of a sudden suppression of the menses, did not recover it again till three months after the return of the menstrual discharge, notwithstanding every sort of evacuation was tried. He also tells us of another woman, who had been blind half a year, and did not menstruate, and to whose external parts of generation leeches were several times applied. As often as the leeches were put on (says Richter,) the menses in part recommenced; and, as long as they made their appearance, which was seldom above two hours, the woman always enjoyed a degree of vision. (*Anfangsgr. der Wundarzn. b. 3. p. 443.*)

For the amaurosis, arising from suppression of the menses, Scarpa recommends leeches to the labia pudendi, bathing the feet in warm water, and afterwards exhibiting an emetic, and the resolvent pills, of which I shall presently speak. If these means fail in establishing the menstrual discharge, he says, great confidence may be placed in a stream of electricity, conducted from the loins across the pelvis, in every direction, and thence repeatedly to the thighs and feet. He enjoins us not to despair at want of success at first, as the plan frequently succeeds, after a trial of several weeks.

For the amaurosis, proceeding from the stoppage of an habitual copious bleeding from piles, Scarpa recommends the application of leeches and fomentations to the hemorrhoidal veins, then giving the patient an emetic, and afterwards the opening pills hereafter described. (*Saggio di Osservazioni e d'esperienze sulle principali molattie degli occhi, cap. 19.*)

When the disease does not originate from the stoppage of any natural or habitual discharge of blood, and does not yield to the evacuating plan, Richter thinks, that the surgeon is justified in concluding, that the preternaturally dilated vessels have not regained their proper tone and diameter, and that he ought to employ topical corroborant remedies, particularly cold water. In this kind of case, Richter is an advocate for washing and bathing the whole head with cold water, especially the part about the eyes: a method, he says, which may often be practised after evacuations, with singular and remarkable efficacy.

When the return of sight cannot be brought about in this manner, Richter advises us to try such means, as seem calculated to stimulate the nerves, and remove the torpid affection of the optic nerves in particular. Of these last remedies, says he, emetics are the principal and most effectual. Soldiers, who lose their sight in performing forced marches, in hot weather, very commonly have it re-established again, by being immediately bled, and taking an emetic the next day. (See *Schmucker's Chir. Wahrnehmungen 1. Theil.*)

We come now to the consideration of that species of the gutta serena, which is regarded as the effect of some unnatural irri-

tation. Here, according to the precepts delivered by Richter, we should endeavour to discover what the particular irritation is, and then endeavour to effect its removal. When it cannot be exactly detected, we are recommended generally to employ such remedies, as will lessen the sensibility of the nerves, and render them less apt to be affected by any kind of irritation.

Sometimes the irritation is both discoverable and removeable, and still the effect, that is to say, the blindness, continues. In this circumstance, Richter thinks, that the surgeon should endeavour to obviate the impression, which the irritation has left upon the nerves, by the use of anodynes; or else, try to remove the torpor of the nerves by stimulants.

But, according to Schmucker, Richter, and Scarpa, the curable imperfect amaurosis commonly depends on some disease, or irritation, existing in the gastric system, occasionally complicated with general nervous debility, in which the eyes participate. Hence, in the majority of cases, we are assured, that the chief indications are, to free the alimentary canal from all irritating matter, improve the state of the chylopoietic viscera, and invigorate the nervous system in general, and the nerves of the eye in particular.

For an adult, dissolve three grains of antimonium tartarizatum in four ounces of water, and give a spoonful of this solution, every half hour, until nausea and copious vomiting are produced. The next day some opening powders are to be exhibited, consisting of an ounce of the supertartrate of potash, and one grain of antimonium tartarizatum, divided into six equal parts. The patient must take one of these in the morning, another four hours afterwards, and a third in the evening, for eight or ten days in succession. They will create a little nausea, a few more evacuations from the bowels than usual, and, perhaps, in the course of a few days, vomiting. If the patient, during their use, should make vain efforts to vomit, complain of bitterness in his mouth, loss of appetite, and no renovation of sight, the emetic, as at first directed, is to be prescribed again. This is to be repeated a third and fourth time, should the morbid state of the gastric system, the bitter taste in the mouth, the tension of the hypochondria, the acid eructations, and the inclination to vomit, make it necessary. The first emetic often produces only an evacuation of an aqueous fluid, blended with a little mucus; but, if it be repeated, a few days after the resolvent powders have been administered, it then occasions a discharge of a considerable quantity of a yellow, greenish matter, to the infinite relief of the stomach, head, and eyes.

The stomach having been thus emptied, Schmucker's or Richter's resolvent pills are to be ordered.

These are composed as follows;

R. Gum. Sagapen. } an. ʒj
Galban. }
Sap. Venet.
Rhei optim. ʒiiss
Tart. Emet. gr. xvi.
Suc. liquerit ʒj fiant pilulæ gran. quinque.

Three of these pills to be taken every morning and evening for a month, or six weeks.

R. Gum. Ammoniac. }
Ass. foetid. } an. ʒij
Sap. Venet.
Rad. Valer. s. p.
Summit. Arnicæ.
Tart. Emet. gr. xvij. fiant pilulæ gran. quinque.

Six to be taken thrice a day for several weeks.

The pills are here directed to be made larger, than Schmucker and Richter order, so that the number in one dose may be diminished; for, to prescribe 15 pills, three times a day, might seem absurd to the generality of patients in this country.

When the above plan has rectified the state of the stomach, and partly effected the restoration of sight, such remedies must be employed, as strengthen the digestive organs, and excite the vigour of the nervous system in general, and of the nerves of the eye in particular. A powder is to be prescribed, composed of an ounce of bark, and half an ounce of valerian, divided into six equal parts, one of which is to be taken in the morning, and another in the evening, in any convenient vehicle, for, at least, five or six weeks. During this time, the patient's nourishment must consist of tender succulent meat, and wholesome broths, with a moderate quantity of wine, and proper exercise in a salubrious air. For exciting the action of the nerves of the eye, the vapour of liquor ammoniac, properly directed against the eye, is of the greatest service. This remedy is applied by holding a small vessel, containing it, sufficiently near the eye to make this organ feel a smarting, occasioned by the very penetrating vapours, with which it is enveloped, and which cause a copious secretion of tears, and a redness, in less than half an hour after the beginning of the application. It is now proper to stop, and repeat the application three or four hours afterwards. The plan must be thus followed up till the incomplete amaurosis is quite cured. The ammoniacal vapours should be used as soon as the stomach has been freed from all irritating matter, and they should not be discontinued, till long after the eye has been cured.

The operation of these vapours may be aided by other external stimulants, applied to such other parts of the body as have a great deal of sympathy with the eyes. Of this kind are blisters to the nape of the neck; friction on the eyebrow with the anodyne liquor; the irritation of the nerves of the nostrils by sternutative powders, like that composed of two grains of turbith mineral, and a scruple of powdered betony leaves;

and, lastly, a stream of electricity. For some additional observations on the effect of electricity in cases of amaurosis, see *Gutta Serena*.

Bark, which is efficacious in intermittent fevers, and other periodical diseases, far from curing the periodical amaurosis, seems to exasperate it, rendering its return more frequent, and of longer duration. On the other hand, this disease is most commonly cured, in a very short time, by exhibiting first emetics, then opening pills containing antimonium tartarizatum, and gummy saponaceous substances, and lastly, corroborants, and even bark, which was before useless and hurtful.

Such is the statement of Professor Scarpa, which agrees with the sentiments already cited from Richter, respecting the effect of bark in periodical amaurosis. As if, however, practitioners were doomed always to differ, and learners to be puzzled, Beer tells us, that he has seen only two cases of periodical intermittent amaurosis, both of which were soon perfectly cured by large doses of bark. Other periodical amaurotic affections he has seen, however, attendant on intermittent fever, but they spontaneously subsided with the febrile paroxysms, without any particular treatment being applied to the eyes. Sometimes, when the paroxysms recurred frequently, a considerable weakness of sight remained after them; but, this always went off of itself, except in a single instance, in which the functions of the eyes were perfectly re-established by the exhibition of arnica, joined with bitters. (See Beer's *Lehre von der Augenkr. B. 2, p. 585.*)

In the two cases, which were unaccompanied with fever, the vitreous humour had the appearance of being turbid during the attacks, but regained its natural clearness on each return of vision, the loss of which used to be complete. Here we see another instance, in which a cloudiness behind the pupil in amaurosis did not impede the cure, and went away in the most ready manner. Possibly, the opacity, which in speaking of the prognosis, I said that Langenbeck had not found to prevent the cure of certain cases, might also have had its seat in the vitreous humour, and not depended upon disease of the retina.

Scarpa finds, that the above plan of curing the recent imperfect amaurosis succeeds in the majority of cases, where the disease is only sympathetic, or dependent on the morbid state of the gastric system. But, there are cases, in the formation of which many other causes operate, besides the most frequent one already stated. These demand the employment of particular curative means, in addition to those which have been already described. Such is, for example, the imperfect amaurosis, which occurs suddenly, in consequence of the body being excessively heated, or exposure to the sun, or violent anger, in plethoric subjects. This case requires, in particular, general and topical evacuations of blood, and the appli-

cation of cold washes to the eyes and whole head. An emetic should next be given, and afterwards a purge of potassæ tartras, or small repeated doses of antimonium tartarizatum. Schmucker relates, that by means of bleeding and an emetic, he has often restored the eyesight of soldiers, who had lost it in making forced marches, with very heavy burdens. In amaurosis, suddenly occasioned by violent anger, an emetic is the more strongly indicated after bleeding, as the blindness, thus arising, is always attended with a bitter taste in the mouth, tension of the hypochondria, and continual nausea. Richter gives an account of a clergyman, who became completely blind, after being in a furious passion, and whose eyesight was restored the very next day, by means of an emetic, which was given with a view of relieving some obvious marks of bilious disorder in the stomach.

Scarpa's treatment of the imperfect amaurosis brought on by fevers, deep sorrow, great loss of blood, intense study, and forced exertions of the eyes on very minute or brilliant objects, consists also in removing all irritation from the stomach, and afterwards strengthening the nervous system in general, and the nerves of the eye in particular. In the case originating from fevers, the emetic and opening pills are to be given; then bark, steel medicines, and bitters; while the vapours of the liquor ammonia are applied to the eye itself.

When the disorder has been brought on by grief, or fright, the stomach and intestines are to be emptied by means of antimonium tartarizatum, and the opening pills; and the cure is to be completed by giving bark and valerian; applying the vapour of liquor ammonia to the eyes; ordering nourishing, easily digestible food; diverting the patient's mind, and fixing it on agreeable objects, and recommending moderate exercise. The amaurosis from fright is said to require a longer perseverance in such treatment, than the ease from sorrow. (*Scarpa's Osservaz. Cap. 19.*)

The third species of gutta serena, or that which arises from debilitating causes, is of two kinds; in one, the disease is the consequence of a general weakness of the body; in the other, it is the effect of debility, which is confined to the eye itself, and does not extend to the whole constitution.

According to Scarpa, the incomplete amaurosis from general nervous debility, copious hemorrhage, convulsions *ab inactione*, and long continued intense study, especially by candlelight, is less a case of real amaurosis, than a weakness of sight from a fatigued state of the nerves, especially of those constituting the immediate organ of sight. When this complaint is recent in a young subject, it may be cured, or diminished by emptying the alimentary canal with small repeated doses of rhubarb, and then giving tonic cordial remedies. At the same time, the patient must abstain from every thing that has a tendency to weaken the nervous system, and, consequently, the

eyesight. After emptying the stomach and bowels, it is proper to prescribe the decoction of bark with valerian, or the infusion of quassia with the addition of a few drops of sulphuric ether to each dose, with nourishing, easily digestible food. The aromatic spirituous vapours (mentioned in the article *Ophthalmia*) may then be topically applied; or if these prove ineffectual, the vapour of liquor ammoniac. The patient must take exercise on foot, horseback, or in a carriage, in a wholesome, dry air, in warm weather, and avail himself of sea-bathing. He must avoid all thoughts of care, and refrain from fixing his eyes on minute shining objects. In proportion as the energy of the nervous system returns, and the constitution is strengthened, the sight is restored. In order to preserve and improve this useful sense, the patient must adopt, above all things, every measure calculated to maintain the tone of the stomach, and moderate the impression of light on the retina. This object can easily be fulfilled by always wearing flat green glasses before the eyes, in a vivid light. (*Saggio di Osservaz. Cap. 19.*)

When the weakness is confined to the eye only, Richter thinks the topical employment of corroborant applications alone necessary. Bathing the eye with cold water, says he, is one of the most powerful means of strengthening the eye. The patient should dip in cold water a compress, doubled into eight folds, and sufficiently large to cover the whole face and forehead, and this he should keep applied, as long as it continues cold. Or, else, he should frequently apply cold water to his eyes and face with his hand, on a piece of rag.

The eye may also be strengthened by repeatedly applying blisters of a semi-lunar shape above the eyebrows, just long enough to excite redness. Richter likewise speaks favourably of rubbing the upper eyelid, several times a day, with a mixture of the tinctura lyttae and spiritus serpilli, great care being taken, that none of the application come into contact with the eye itself. Spirituous and aromatic remedies in general, are also proper. (*Anfangsgr der Wundarz. B. 3, p. 452.*)

When no probable cause whatsoever can be assigned for the disease, the surgeon is justified in employing such remedies, as have been proved by experience to be sometimes capable of relieving the affection, although upon what principle is utterly unknown. The chief means of this kind are emetics, given in small doses, so as to excite nausea, and occasionally in larger ones, in order to produce vomiting; Schmucker's pills, the composition of which has been already described, sometimes assisted with the exhibition of arnica and valerian; preparations of mercury either alone, or in conjunction with sarsaparilla, cicuta, or sulphur auratum antimonii; valerian in powder, either alone, or joined with decoction of bark, containing either subcarbonate of ammonia, or sulphuric ether; pulsatilla, in the form of an

extract or an infusion; the extractum hyocyami albi, with or without antimonial wine, and various other medicines and applications, which will be considered under the head *Gutta Serena*. To this article, I would refer the reader, before he makes up his mind about any empirical method of treatment, because he will there find many cautions and instructions given by Beer respecting the remedies for amaurosis in general. To his remarks, I have also annexed such others on the same topic, as appeared to me interesting.

In the following view of amaurosis, chiefly taken from the valuable writings of Prof. Beer, the reader will find a more complete history of the different forms of the disease, and their varieties, than has previously been drawn up in our language. The only points, on which Beer perhaps ventures too far, are those relating to the etiology of the several cases; a subject, in which he displays the usual credulity of the continental surgeons. With his observations, I have taken the liberty to blend a few additional remarks, not caring about the length of the article, where the matter seemed new and interesting.

1. OF THE DIFFERENT FORMS OF AMAUROSIS IN GENERAL.

Beer reckons four species of amaurosis.

The first is a genuine uncomplicated amaurosis, the characteristic symptom of which consists peculiarly and entirely in an impairment or loss of vision, without any morbid change in the organic matter of the eye.

Secondly; there is an amaurosis, which, besides being attended with a diminution, or total loss of vision, is also accompanied with appearances of disease in the organic matter of the eye.

Thirdly; there is another amaurosis, in which, together with the above principal symptom, viz. weakness, or loss of sight, there are also morbid phenomena exhibited in the form of the eye in general, or its particular textures, and especially in the action of the irritable parts.

Lastly; Beer says, he can often point out an amaurosis, in which all the characteristic symptoms of the three preceding cases are more or less combined. (See *Lehre von den Augenkr. B. 2, p. 478.*)

Professor Beer's First Species of Amaurosis.

The genuine uncomplicated amaurosis, consisting of a mere diminution or loss of sight, without the appearance of any other defect, is one of the most uncommon forms of complaint, not only because singly operating causes are few, but because they can rarely operate directly upon the optic nerves.

In the true uncomplicated amaurosis, merely the vital qualities of the optic nerve and retina are affected, and after death, no-

thing preternatural can be traced in those parts, either within or on the outside of the eyeball. It is in short, the case, in which the functions of the retina have become imperfect, or destroyed, the eye appearing in other respects sound.

According to Beer, this simple unmixed form of amaurosis is subdivisible into that amaurotic weakness of sight, or blindness, which depends upon the vitality, or rather sensibility of the optic nerve and retina being too highly raised, and into another case, the proximate cause of which is peculiarly and entirely referable to depression of such vitality or sensibility. The first example is much less common than the second.

The general symptoms of the simple uncomplicated species of amaurosis, putting out of consideration the morbid increase, or diminution of the sensibility of the optic nerve, are thus described by Professor Beer. In the first place, all morbid appearances are absent, which might be produced in the amaurotic eye by any one preternatural change in the texture, form, or state of that organ. Hence we are obliged to trust almost exclusively to the patient's assertion, that his sight is bad, or quite gone; and not unfrequently, it is necessary, especially in judicial cases, to employ political artifices, in order to determine whether such assertion be true, particularly when the patient affirms that the blindness is restricted to one eye. Secondly; when the amaurosis is indeed nearly, or quite formed in one eye, a slight degree of strabismus is at most perceptible, arising from the circumstance of the patient's not fixing the eye affected upon any object. This degree of strabismus is noticed by Ackermann and Fischer, as the surest sign of amaurosis. (See *Klinische Annalen von Jena* 1st. p. 144.) And it is particularly pointed out by Richter, as an invariable attendant upon amaurosis. The patient, says he, not only does not turn either eye towards any object, in such a manner, that the object looked at is in the axis of vision; but, he does not turn both his eyes towards the same thing. This was regarded by Richter, as the only symptom, which we can trust, where implicit confidence should not be put in the mere assurance of the patient, that he cannot see, while all the coats and humours of the eyes present their natural appearance. (See *Anfangsgr. der Wundarzn.* B. 3. Kap. 14.) Provided this observation be correct, it must be highly interesting to the military surgeon, amaurosis being a common affliction of soldiers, many of whom, however, endeavour to avoid service by pretending to labour under a disqualification, which they well know does not necessarily produce any very considerable alteration in the natural appearance of the part affected. Thirdly; while the disorder is only in the stage of amblyopia, the patient always complains of continually multiplying *muscæ volitantes*, or of the *visus reticulatus*, or *nebulosus*. Fourthly; luminous forms appear before the eyes, especially in the dark, even when

the patient is entirely blind. Fifthly; the decrease of vision goes on to complete blindness, without any material interruption, or retrogression. Sixthly; when only one eye is quite blind, and the eyesight on the other side is perfectly undisturbed, there is one infallible symptom of this amaurosis, namely, *if the sound eye be very carefully covered, the pupil of the blind one immediately expands, and the iris becomes quite motionless, notwithstanding the diseased eye be exposed to the strongest light possible.* However, this criterion is mostly wanting, because the amaurosis, which is attended with no appearance of defect, except loss of vision, is seldom confined to one eye, but usually affects both. (See *Lehre von den Augenkr.* B. 2. p. 481—82.

1. *Of the genuine uncomplicated Amaurosis, dependent upon what Beer terms preternaturally high Vitality, or rather, as we should say, a Morbid Increase of Sensibility of the Optic Nerve.*

This form of amaurosis is described by Beer as having two stages: in the first, the patient never becomes blind; the eyesight being lost at the end of the second stage. This species of amaurosis always forms with great quickness, so that the limits between the two stages are frequently very indistinct.

The first stage commences with a peculiar sensation of fulness in the eye-ball, conjoined with continually increasing, violent, and annoying luminous appearances, and a remarkable weakness of sight. These symptoms are soon followed by a stupifying constantly increasing headach, during which the power of vision manifestly diminishes, without the slightest defect being perceptible either in the eye itself, or its surrounding parts. The patient, however, is always marked by an athletic constitution, or at all events, by such symptoms of general and local plethora, and of a phlogistic diathesis, as cannot be mistaken.

Upon the advance of the disorder into its second stage, the headach becomes irregular, being less violent at some periods than others; the patient feels as if there were before his eyes, a thick net, or gauze, which, in a bright light, appears quite black, but in the shade, fiery and shining. This net or gauze, when there is any temporary determination of blood to the head and eyes, as in straining at stool, is immediately rendered considerably more dense; and when such determination of blood is often repeated, or long maintained, the density at length remains much greater than before, and consequently, the patient suddenly grows more blind, and is very quickly quite bereft of vision. This complete loss of sight, in the second stage, if efficient assistance be not given, is ultimately produced by the progress of the disease, even without any accidental determination of blood, though never quite suddenly. At last all power of discerning the light is abolished, under in-

cessant stupifying headaches, which are sometimes weaker, sometimes stronger, and are attended with a sensation, as if the dimensions of the eye were increased, and indeed, it really feels harder, than in the healthy state.

All those circumstances, which produce a long and repeated determination of blood to the head and eyes, must be considered as the principal causes of this kind of amaurosis. Beer especially adverts to the habit of sleeping at night with the head low, in individuals who retire early to rest, and with their arms extended above their head. Here also the observations are nearly all applicable, which have been already delivered respecting the effects of immoderately exerting the eyesight and intellects, and concerning the too great irritation of the eye by the light in typhoid fevers. Nor, in the etiology of this species of amaurosis, should what has been stated about idiosyncrasies be forgotten. (*Lehre von den Augenkr.* p. 483—85.)

While the first stage has not yet terminated, and consequently while the power of vision is not obliterated, if the patient can and will put himself without delay into the requisite condition for the cure, a favourable prognosis may invariably be given. But the prognosis is much less promising, when the second stage has already begun, or is threatening to begin, and consequently when the power of seeing is either completely or nearly destroyed, notwithstanding the blindness may not be of more than two days' standing; particularly, if the patient cannot immediately have the best assistance. However, some slight hope of a re-establishment of sight may always be entertained, even though the amaurosis be complete, if it be not of long standing. But when the disorder has existed several months, it is hardly ever practicable to do more than restore a very partial degree of vision. When, in typhus fever, this amaurosis has been brought on altogether by the immoderate irritation of the light, Beer has constantly found the case quite irremediable, the general debility, which often lasts so long after typhus, having no slight share in the prevention of a cure. The prognosis is most favourable, when the amaurosis depends upon some idiosyncrasy which is known, and can be at once removed; and very discouraging is the prospect of relief, when many different causes are concerned in the production of the complaint: while that true sympathetic amaurosis, which arises not merely from over exertion of the eye, but also from great and immoderate mental application, is very serious, both with respect to the fate of the eye itself, and the life of the patient, amaurosis, under these circumstances, being not unfrequently the forerunner of impairment of the intellects, or absolute mania. (*Beer, vol. cit.* p. 486.)

As in this species of amaurosis, a determination of blood to the head and eyes is never altogether absent, and has generally

had a great share in the first production of the complaint, it must be self-evident, that during the whole course of the disease, every thing should be rigorously avoided which can tend to bring on such determination of blood, or disturbance of the circulation; and, when these states already exist, no pains must be spared to lessen and remove them. Hence, when general plethora prevails, venesection, especially in the foot, is the earliest indication; and, if this be not effectual, and the local plethora in the head and eyes still continues, topical bleeding with leeches, &c. must be practised. But, if no signs of universal plethora exist, and there be merely a determination of blood to the head and eyes, local bleeding will be sufficient. At the same time, bathing the feet in lukewarm water, containing salt, or mustard, or applying sinapisms of mustard to the calves, and using gentle opening clysters, aperient medicines, cooling drinks, and a strict vegetable diet, will very much contribute to lessen the determination of blood, and any existing impetuosity of the circulation. These antiphlogistic curative means must be aided by keeping the eyes in a natural, yet complete state of rest, and in particular by keeping the whole body quiet in the recumbent posture, with the irritation of what would otherwise be only an ordinary degree of light, constantly diminished. Nay, in typhoid patients, attacked with this form of amaurosis, the interception of the light by blinds and eyescreens, or a light fine linen bandage, will be of itself effectual to arrest the disorder at once, and prevent blindness, unless the first stage be already too far advanced. When the most careful adoption of the foregoing means is only followed by an imperfect and slow return of vision, the treatment is to be aided by cold bathing of the eye, in practising which care must be taken not to let the patient's head lean forwards. According to Beer, the sympathetic amaurosis, unaccompanied by any appearance of organic disease, and brought on by immoderate exertion of the brain, always demands, in its first stage, not only local, but general antiphlogistic treatment, even though no particular plethora may be present.

When the surgeon meets with this species of amaurosis in the second stage, local fluid stimulants, and tonic remedies, must first be gradually employed. These are to be applied, partly by rubbing them upon the eyebrow, and partly in the form of the vapour of ether directed immediately against the eye. An attempt must also be made to restore the sensibility of the optic nerve, by rubefacients, and, if these be unavailing, by such means as occasion a shock of the vessels and nerves. When, however, it is clear that liniments and vapours of ether are quite ineffectual, these local measures must be combined with suitable general means: a light nutritious diet; an allowance of wine and beer; daily exercise in the open air, particularly in sunshiny meadows, until

the patient be rather fatigued; the slow ascent of hilly places; the exercise of pumping or sawing wood in winter; bathing in mineral steel waters, &c. and the empirical use of antiparalytic and tonic remedies, among which latter, steel medicines are to be employed with the greatest circumspection. (Beer, *Lehre von den Augenkr. b. 2. p. 487—88.*)

2. *Of the genuine uncomplicated amaurosis, which arises from (what Beer denominates) preternatural depression of the vitality (sensitivity) of the optic nerve.*

According to Beer, this amaurosis differs from the preceding, by its formation being scarcely ever quick, but usually very slow, and its not exhibiting any traces of those two very different stages, which are peculiar to the other case. It also invariably commences with the visus reticulatus, or nebulosus, without any alternation with a blinding glare of light; and the eyesight is sometimes considerably better, and sometimes weaker, which always depends upon the accidental operation of internal or external circumstances. Thus, it may be noticed, that, in these cases, immediately after a good repast, the enjoyment of excellent wine and liquor, after unexpected great joy, after the spirits have been raised by the pleasures of a convivial party, or directly after a violent fit of anger, the sight undergoes great amendment. On the other hand, sudden fright, great anxiety, profound grief, loss of sleep, long fasting, &c. constantly produce an immediate aggravation of the blindness; and the difference between these effects is, that the melioration of the eyesight never continues long, while the diminution of it not only remains, but gets worse and worse. It is not at all uncommon for this species of amaurosis, to make its appearance as a nightblindness, because common artificial light is much too feeble to make due impression upon the diminished sensibility of the optic nerve; and consequently these patients always show a partiality to a very strong light. To such weak-sighted individuals, the flame of a candle, or the moon, appears as if covered by a dense veil, with an expanded halo round it of various colours. There is no complaint made of pain in the head or eyes; and no sensation of fulness or weight is experienced in the eyeball; much less are there any empirical symptoms of the disease in the structure and form of the eye, or in the action of its irritable textures; but the amaurosis, especially when it has been long complete, is usually conjoined with a debilitated habit.

Every thing, says professor Beer, which tends to produce considerable constitutional weakness, either locally in the eyes, or both locally and constitutionally, must at least be regarded as a more or less obvious cause of this amaurosis; that is to say, when the case is a mere impairment or loss of sight without other morbid appearances;

for, as we shall presently find, there are several kinds of amaurosis, which, though they depend upon direct local debility, or local and general debility together, do not by any means arise in the form of simple diminution or loss of sight, free from every appearance of complication and disease in the eye: here belong especially shocks affecting the optic nerve, the brain, or the whole nervous system, produced rather by moral than physical causes; for a simple physical shock of the nerves, especially when it falls directly upon the eye, commonly produces at once a considerable diminution of cohesion in the nervous texture, as is more or less evinced by the appearances of the eye in general, and by the action of its irritable parts in particular. Secondly must be reckoned every very considerable and long-continued loss of blood or other nutritious fluid. Thirdly, a long residence in a dark place, and the entire nonemployment of the eye. Fourthly, the debility of age, and dulness of the whole nervous system, particularly when the patient's eyesight has been abused in his youth by immoderate exertion, and the eyes are of a dark colour. Fifthly, the present form of amaurosis sometimes comes on as an immediate consequence of typhus, especially when the fever has been attended with severe diarrhoea, and nasal hemorrhage, not of a critical, but of a mere symptomatic kind, hardly admitting of suppression; but, in the latter case, the amaurotic blindness is rarely complete. Beer questions whether, in typhoid patients, the absorption of the fat in the orbit, and the extraordinary retraction of the globe of the eye into that cavity, may not have a share in producing this amaurotic weakness of sight. (*Lehre von den Augenkr. b. 2. p. 491, 92.*)

With respect to the prognosis, this species of uncomplicated amaurosis, unattended with any defect in the structure of the eye, is generally much seldomer curable than the former, because the cause of the disorder usually consists of an assemblage of many concealed and difficultly discoverable circumstances, and because it is rarely possible to put the patient under all the conditions, which are essential to the cure, even when the causes of the disease are understood; as for instance, when the disease has arisen from extreme indigence, or domestic trouble. Even when a cure is effected, it is with the greatest difficulty, and not till after a considerable time. Hence, though circumstances may have a favourable appearance, no promise should be made, and when the amaurosis is already complete and of long standing, great patience must be enjoined during the treatment. In very poor persons, and in hospitals, says Beer, this species of amaurosis may always be regarded as incurable, because, in such examples, the operation of the medicines indicated can never be properly seconded by diet, nutritious food, mental encouragement, and requisite exercise in an open pure air.

At the commencement of the disorder, the depressed vitality (or rather sensibility) of the optic nerve should be raised, if possible, by the gradual use of stimulating liniments, and the vapour of ether. The rest of the treatment, recommended by Beer, resembles that of the second stage of amaurosis from morbid sensibility of the optic nerve. His plan is also to try the use of weak remedies first, and then gradually those which have the most powerful operation. (*Beer, vol. cit. p. 493, 94.*)

Beer's Second Species of Amaurosis; Cat-eye Amaurosis.

This species of the disorder, of which Beer has yet met with but one form, rarely increases to complete blindness; it occurs chiefly in very old persons, and it is perhaps this affection to which some oculists have given the unmeaning name of *amblyopia senilis*. Sometimes, however, this kind of amaurosis takes place in young persons and children; and one circumstance, that demands particular notice, in its nosology, is, that it always takes place either in thin, dwindled, old, gray-headed subjects, nearly in the state of *marasmus senilis*, in whom consequently the exchange of organic matter is carried on but tardily, or else in young subjects, who are unhealthy, and disposed to consumption, hectic adults, emaciated children, and as a consequence of severe injuries of the eye. While this amaurosis is not perfectly formed, the iris retains its mobility, and the pupil is neither preternaturally dilated, nor contracted; but when once the patient is quite bereft of vision, the motions of the iris are slow, and the pupil larger than in a healthy eye in an equal degree of light. At the bottom of the eye, very far behind the pupil, a concave pale gray, bright yellowish, or variegated reddish opacity is developed. By this the eyesight is not merely weakened, but rendered quite confused, since all objects, but especially smallish ones, appear to be confounded together, particularly when the patient tries to inspect closely any determinate body. The further the disease advances, the brighter and more visible is the bottom of the eye, the paler is the colour of the iris (a thing very conspicuous in dark-eyed persons,) and when once the amaurosis is complete, so that no susceptibility of the impression of light is left, then, upon an attentive examination of the eye, one can mostly perceive, at the troubled deeper part of the eye, a very slender vascular plexus, which merely consists of the ordinary ramifications of the central artery and vein, which are now visible at the pale-coloured bottom of the eye. In a half-darkened place, such an eye presents a shining yellowish, or reddish appearance, but only in certain positions of the eyeball; and, in this respect, it is somewhat similar to the eye of a cat, whence Beer chooses to term the complaint cat-eye amaurosis. The disorder is also not accompanied with

any other essential morbid appearances, except the decline of vision, or complete blindness. (*Lehre von den Augenkr. b. 2. p. 496.*) Beer, in fig. 1. tab. 4. of his second vol. has given, from nature, an admirable representation of this very remarkable species of amaurosis. The differences in the appearances at the bottom of the eye, in this case, from those presented in the early stage of fungus hæmatodes of that organ, will be best understood by referring to the article *Fungus Hæmatodes*.

Beer observes, that the causes of this species of amaurosis are so obscure, that whatever is offered upon the subject can be received only as conjecture. After what has been said in the foregoing paragraph is considered, about the particular individuals who are liable to be affected, and the change of the iris to a pale colour, as a constant symptom of this case, a suspicion may be entertained, that a deficiency of the pigmentum nigrum, and of the tapetum of the uvea, in consequence of the stoppage of this secretion, may be the cause of the disease. Beer justly remarks, that much might be learned on this point from the dissection of eyes thus affected; but he has never met with the opportunity.

Nothing being known about the etiology, the prognosis cannot but be very unfavourable; for, as the surgeon is ignorant of causes, he cannot know what means ought to be adopted for their removal. It is fortunate, however, that this amaurosis rarely attains its highest degree, but almost constantly remains in the form of a more or less considerable amblyopia.

Just as little is yet known respecting any well-regulated mode of treatment: all that Beer has learnt from his own opportunities of remark is, that, in individuals prone to consumption, or somewhat hectic, but not dangerously so, and especially in emaciated children, whose bellies are not at the same time tense and hard, this amaurotic impairment of sight may sometimes be kept from getting worse, by the careful employment of such general remedies, regimen, and diet, as are calculated to improve the health. But, in the most fortunately managed cases, Beer has never seen a step made towards the removal of the disease. (*Lehre von den Augenkr. b. 2. p. 497, 98.*)

Beer's Third Species of Amaurosis, and its Varieties.

1. *Of the amaurosis which is produced by the abuse of bitters, by coal-smoke, or the effect of lead.*

This amaurosis in its progress presents different stages, to which the utmost attention must be paid in order to avoid treating the case wrongly, or producing complete blindness. The limits between these stages, however, are so faintly marked, that one cannot wonder at their being overlooked by a superficial observer. In the first stage, the complaint never induces entire blind-

ness, but only a more or less considerable diminution of vision.

A manifest turgescence of the blood-vessels, not only in the conjunctiva, but in the sclerotica itself; a disagreeable sensation of fulness in the eye; a perfectly motionless state of the iris; a very considerable dilatation of the pupil; and a peculiar undescribable pale-blackness of that opening, without any appearance that can be called turbidness; a singular pellicle-like cloud, which renders larger objects indistinct, and quite conceals all smaller ones; and, finally, a more or less remarkable trembling of the limbs; are the characteristic symptoms of the first stage.

On the other hand, says Beer, in the second stage, the patient is quite deprived of vision; the pupil is exceedingly large; the iris quite motionless, even when the eyelid is rubbed over the eye; the pupillary edge of the iris is angular, usually only towards the two canthi, so that the breadth of the iris is greatest in the perpendicular direction; nearly every part of the white of the eye exhibits a faint redness; the edges of the eyelids, especially in fair persons with a very delicate irritable skin, are somewhat discoloured; the upper eyelid in consequence of relaxation, hangs farther down over the eye, than natural; the movements of the eye and eyelids are languid; and different muscles are affected with spasm, especially those of the limbs and spine. If, in this stage of the disorder, the power of distinguishing light be completely abolished, then the other external senses, and, at last, the internal ones, but particularly the hearing, speech, and memory, fail. Nay, not unfrequently this form of amaurosis is attended with delirium, and, when produced by the poison of lead, it may be accompanied with lead-colic, ileus, and contractions of the hands and feet.

The abuse of bitters of every kind, whether as articles of food or medicine, especially chicory-coffee, bitter almonds, various high-seasoned dishes, quassia, &c.; likewise of narcotics, especially opium, hyoscyamus, belladonna, thorn-apple, and cynoglossum; lastly, the long-continued and imprudent employment of preparations of lead, paint, &c.; the application of lead cosmetics, and accidental preparations of this mineral, adulterated wine, &c. are the causes of this form of amaurosis, which Beer has often seen, and mostly treated with success.

While the disease is in its first stage, the prognosis is always very favourable, indeed sometimes the blindness now goes off again, without any interference from art. This may happen when it has not yet attained a considerable degree; when the patient avoids every thing conducive to the disease; when he accidentally places himself under such circumstances, as promote the recovery; and when he is not very plethoric; there is no determination of blood to his head and eyes; he has not a phlogistic diathesis; he is not disposed to obstinate constipations; and the amaurotic weakness of

sight has not occurred in the advanced stage of pregnancy. However, Beer is convinced, from repeated observation, that this amaurosis, even though it be not quite in its second stage, and it be skilfully treated, may last a long while, when produced by belladonna, stramonium, and the poison of lead.

When once the disorder reaches its second stage, and the patient is completely blind, the prognosis becomes very serious, though somewhat less so if a glimmering of light can be discerned. But, if all sense of light be lost when the surgeon is first consulted, no promises must be made; or, at most, only a remote and distant hope of the re-establishment of sight must be allowed, notwithstanding all other circumstances may be favourable to the cure. When, however, in a completely amaurotic eye of this kind, any thing wrong is visible in the transparent parts of the organ, or there is a strong tendency to a general varicose affection of its blood-vessels, the complication is always very unpromising, as sooner or later violent pains supervene, and the blindness is irremediable.

When in the first stage of this complaint recourse is at once had to fluid stimulant remedies, useful as they are in the second, it is lucky if the patient do not completely lose his sight. On the contrary, when no complications exist, and the impairment of vision is altogether the effect of the above mentioned causes, a gentle antiphlogistic treatment will preserve him from such a misfortune. Taking away a few ounces of blood, by venesection, when plethora exists; the application of leeches behind the ears, when, after bleeding, a determination of blood to the head and eyes still continues in full habits, or there is any tendency to inflammation. The same topical bleeding, without venesection, and lukewarm pediluvia, containing salt, or mustard, are proper, when no general plethora exists; and merely a determination of blood to the head and eyes, and some acceleration of the circulation prevail. Internally, diluted white wine vinegar, lemon juice, or the liquor ammoniæ acet. have excellent effects; and externally, poultices composed of bread crum and vinegar, or fomentations with oxycrat, are the means which Beer has found most successful in the first stage of this form of amaurosis.

As in the first stage, a moderate antiphlogistic general or local treatment is the only one, which can be adopted, and which in urgent cases may yet save the patient from blindness, so, in the second stage, the internal and external employment of fluid stimulants is of great service; for example, naphtha combined with camphor inwardly; liniments to the eyebrow, and the vapours of ether to the eye. The amaurosis, which is produced altogether by the poison of lead, and is complicated with lead colic and ileus, will require, in addition to the foregoing means, such remedies as are known to be of service in these latter disorders.

(Beer, *Lehre, von den Augenkr.* B. 2. p. 499—503.)

2. Of the symptomatic amaurosis in individuals affected with hysteria, hypochondriasis, epilepsy, and convulsions.

This amaurosis is rarely permanent, and usually subsides as soon as the spasmodic, epileptic, or convulsive attack is over. However, the complaint may begin at two periods, viz. either during such an attack, or (what is more uncommon) afterwards, and it never loses its symptomatic character. The pupil always remains perfectly clear, and of a shining blackness, even when the disease has induced entire blindness; but, a slight dull pain in the forehead, especially about the eyebrow, constantly preceding and accompanying the blindness, generally lasts a good while after the amaurosis has completely subsided.

Besides the foregoing general symptoms, the following characteristic appearances present themselves in hysterical and hypochondriacal patients, who suffer frequent attacks of violent spasm. The pupil is much dilated, and the iris, which is immovable, seems evidently to project in a convexity forwards, when the eye is inspected sidewise; consequently, the anterior chamber is lessened. The eye itself does not move freely in its socket, the patient experiencing an annoying, and sometimes a truly painful sensation, as if the eyeball were forcibly compressed; (*Ophthalmodynia*.) Every attempt, which the patient himself makes to move the eye, or the surgeon to push it out of the position, which it has assumed, is unavailing, and excessively painful. The eyelids are either painfully shut, or incapable of being shut at all; the eyesight is very weak, but seldom quite impeded; and, at the termination of each attack, it returns, though every paroxysm leaves it more and more debilitated, until at length, the spasmodic attacks of blindness frequently occurring, and lasting a long while, it is entirely lost. But, when the disorder has acquired its utmost degree, the eye always still retains the power of discerning the light, and it seldom happens, that vision is abolished by the first or second attack. It is different, with respect to the characteristic phenomena of this amaurosis, in hysterical or hypochondriacal patients, especially when often affected with spasms, before, during, or after which the impairment of sight originates: for though the pupil may continue quite clear it cannot escape the notice of an attentive observer, that, together with a pupil of diminished diameter, there exists a peculiar motion of the iris, a constant fluttering of it between expansion and contraction, technically called *hippus pupillæ*. This convulsive state of the iris is mostly accompanied with a similar affection of the eyelids, namely, with an involuntary blinking, *nictitatio*, and not unfrequently with an involuntary pendulum-like rolling of the eyeball, *nistagmus*. In these patients, the amaurotic injury of sight

hardly ever proceeds directly to complete blindness, but more commonly remains as a weakness of vision, characterized during the rest of life by ceaseless oscillations of the eyeball, aversion to light, and frequent sensations, as if there were shining fiery objects before the eyes.

With regard to the symptoms in epileptic patients, in addition to the general effects above enumerated, this case of symptomatic amaurosis is distinguished by an untroubled, but very expanded pupil; considerable diminution of the motion of the iris; a dilated state of the pupil even under the stimulus of the strongest light, and tremulous motions of the eyeball, which continue during life, after the epilepsy and amaurosis are cured; and the case is further characterized by amblyopia, which rarely increases to complete blindness.

The following are described by Beer as the symptoms in patients affected with convulsions.

As a symptomatic effect in convulsions, this amaurosis most frequently happens in children, they being more liable than adults to convulsions, especially during dentition. The first and most prominent symptom of this incomplete or complete amaurosis consists in an extremely violent convulsive rotation of the eyeball, especially upwards, not unfrequently attended with the most violent convulsive motions of the eyelids. The pupil is excessively dilated, and scarcely the least movement of the iris is distinguishable on exposing the eye to the strongest light. When the general twitchings are over, and only an amaurotic weakness of sight is left, strabismus occurs in both eyes in various directions, though the eyes very seldom deviate from the axis of vision in the direction towards the inner canthus. When the general convulsions happen frequently, and are violent and of long duration, the amaurotic weakness of sight usually changes into perfect blindness, in which the pupil, though it be regularly clear, and of a shining blackness, is greatly expanded, and the eyes constantly retain their faulty position and pendulum-like motion.

The causes of this amaurosis are specified, as it were, in the title of this section; for, whatever tends to bring on hysteria, hypochondriasis, epilepsy, or convulsions, in an evidently nervous individual, who either has had from birth weak irritable eyes, or has gradually debilitated them by over exertion, may give rise to this species of amaurosis.

With respect to the prognosis, it is observed by Beer, that even when merely an amaurotic weakness remains, the prognosis is always serious; but, it is naturally still more unfavourable, when the blindness is complete, and when the loss of sight has suddenly recurred after violent spasmodic, epileptic, or convulsive attacks, without such attacks themselves ever returning. Under these circumstances, Beer has not hitherto seen more than two instances of

such blindness partially cured. Generally, some hope of recovery may be entertained, when the amblyopia, or even complete amaurosis, begins with these attacks, but always terminates with them, without leaving any serious impairment of vision. On the contrary, it is a very bad sign, not only in regard to the removal of this symptomatic amaurosis, but likewise to the cure of the original disease, when the amaurosis invariably precedes these attacks, and lasts a considerable time after their cessation. As yet, Beer says he has not known any such patients cured, either of their spasms, epilepsy, or convulsions, much less of their blindness: on the contrary, after three or four attacks, perfect amaurosis remains, and some of the patients die in one of these paroxysms.

As this amaurosis is merely a symptomatic effect of the above general disorders, its removal must entirely depend upon the success with which their treatment is conducted. Were the blindness to continue, however, after the cure of the original disease, the surgeon could do nothing more than try an empirical mode of treatment, and ascertain what good could be effected with antispasmodic and tonic medicines. (Beer, *Lehre von den Augenkr.* b. 2. p. 506 —10.)

3. Of the symptomatic amaurosis from infarction, obstruction, and induration of the abdominal viscera.

The following is Beer's account of the complaint. The extremely slow formation of this amaurosis gives it something characteristic; for during ten, twenty, and more years, the patients may have a continually increasing weakness of sight, without becoming completely blind, or rendered quite incapable of following their business. The pupil is invariably found to be dilated, of a pale blackish colour, though very transparent; the somewhat convex iris moves in the varying degrees of light, but very inertly; its pupillary edge is not circular, as in the healthy state, but is drawn into an angle sometimes at one point, sometimes at another; and not only the turgescence of the blood-vessels of the conjunctiva, but a reddish yellowish rather smutty tinge of the whole white of the eye, are evident to the most common observer. As the weakness of sight increases, the patient sees all objects through a thick mist, which, when blindness approaches, seems for a day or two as black as soot, and, for another day or two, of a light gray colour. Hence the patient usually talks of the white and black days. In most patients, those phenomena at length take place, which have been described in speaking of the *visus interruptus*. The purple lips, and wan countenance, correspond to the state of the eyes. A stupefying dull headach, affecting the whole head, and, while any vision is retained, depriving the patient of all inclination to employ his eyes or intellects; a constantly disturbed state of the digestive functions;

and, generally, the whole host of complaints connected with the morbid state of the abdominal viscera, are the never-failing companions of this amaurosis, which, however, does not invariably end in complete blindness.

As for the etiology of this species of amaurosis, every thing that is calculated to induce the above-mentioned morbid state of the abdominal viscera must naturally be taken into calculation; for the affection of the eye is but a symptomatic effect of a general disorder of the chylopoietic organs. Studious persons, and other individuals, who lead sedentary lives, and give immoderate application, or who live upon unwholesome food, are particularly subject to this kind of blindness. However, in duly contemplating its causes, attention must be paid to the almost incessant determination of blood to the head and eyes, prevailing in a greater or lesser degree, and also to the very troublesome hemorrhoidal complaints, as two important circumstances, arising from habitual costiveness, inseparable from the existing state of the abdominal viscera. Further, it is to be understood, that this amaurosis does not attack every individual, who has such disease in the abdomen, but only those whose eyes have been weak, either from birth, or previously to the general complaints, or else, during these complaints, have been immoderately strained.

The surgeon who has learned in practice, and not in the closet, the nature of this chronic disease of the abdominal viscera, and the true nervous connexion between these organs and the affected eyes, and who has also learned from the same source the peculiarity of constitution, habits, &c. of the patient, will know how impossible it is to make any favourable prognosis; for, says Beer, the obstinacy and almost total incurability of the principal complaints, of which the amaurosis is merely a symptom, are known to such a practitioner by the *argumentum crucis*. Even when there is a well-founded hope of cure, Beer argues, that it is difficult to keep the patient under all the requisite conditions for the successful management of the case, on account of his ordinary inflexibility and long-acquired habits. Nay, sometimes, this amaurosis is a very bad omen, in respect to the issue of the case generally; for, according to Beer, when its origin is attended with jaundice, and the affection of the eyes increases with uncommon rapidity to complete blindness, or the jaundice suddenly comes on, during the development of the amaurosis, ascites, or hydrothorax almost always ensues, and, in the latter case, speedy dissolution.

Nothing can be plainer than that, in this alarming case, little can be accomplished by surgery, but that every thing must depend upon judicious medical treatment. Beer remembers with sorrow the time, when, in this kind of amaurosis, such mischief was done by the favourite nauseating plan of treatment, that not a few patients became mournful victims to it. He cannot, there-

fore, too earnestly warn surgeons against that indiscriminate practice, without denying altogether its efficacy, when adopted with the prudence and the cautions laid down in the observations upon various remedies for amaurosis. (See *Gutta Serena*.) Here any employment of external means, even of such as would appear to be of the most innocent nature, always does harm, and if rashly used, or so as chymically to irritate the eye, they may quickly blind the patient. Thus, electricity and galvanism may instantaneously produce complete blindness, attended with severe, obstinate headach; which unfortunate change may be accounted for, when the constant determination of blood to the head and eyes is recollected. If the infarction of the abdominal viscera be successfully removed, the symptomatic amaurosis, depending upon it, is sure to diminish; but when the visceral obstruction and induration are of long standing, the amaurosis is then as incurable as the diseased state of the viscera. (Beer, *Lehre von den Augenkr. B. 2. p. 512—15.*)

4. Of the symptomatic gastric amaurosis.

In no instance has Beer yet seen this amaurosis terminate in complete blindness, excepting when the disease was occasioned by worms in the bowels. The present form of the disorder is always characterized by a considerable dilatation of the pupil, the inner margin of the iris not forming a very regular circle, and the motions of the same organ being exceedingly sluggish, even under the irritation of the strongest light; but the pupil constantly preserves its natural, clear blackness, and there is a frequent involuntary discharge of tears. Besides these pathognomonic symptoms in the eye itself, there are other remote appearances in the constitution, denoting the existence of certain complaints, as the cause of this amaurosis; for when the affection of the eye originates as a sympathetic effect merely, from a redundancy of foul acidity in the stomach, the patient incessantly complains of acid eructations, attended with severe heartburn and epiphora. On the contrary, when the amaurotic weakness proceeds merely from indigestion, the case is accompanied with a tedious, troublesome sense of weight at the scrobiculus cordis; continual eructations, as if occasioned by rotten eggs in the stomach; a yellowish, thickly furred tongue; oppressive thirst; and either an invincible dislike to fish or flesh, and repeated inclination to vomit; or, a swelled belly, and tension of the hypochondria.

On the other hand, when the gastric amaurosis is altogether a sympathetic consequence of worms, it often increases to complete blindness, as Beer has very often remarked, and, in addition to the above described characteristic symptoms, the portion of the sclerotica, surrounding the cornea, has a blue appearance; nay, the eyelids and all the circumference of the eye are said to exhibit quite a peculiar bluish

tinge; while the eye itself is remarkable for its unsteadiness and irregular motions. At the same time children thus affected, as long as they are not blind, usually squint with both eyes, on which account they are not unfrequently reprimanded by their parents and masters, who look upon the deformity as the result of bad habit; a mistake which is the more likely to happen, because these children have a continual irritation and itching in the mucous membrane of the nose, compelling them, as it were, unconsciously, to be frequently picking or wiping their noses. Such children usually have pale countenances; sometimes, also, a true leucophlegmatic habit; an insatiable appetite, and repeated gripings; and, in many cases, considerable swelling and tension of the belly.

As far as Beer's experience reaches, the prognosis in the sympathetic gastric amaurosis is always very favourable, even though the disorder may have attained the degree of complete blindness, provided the complaints, which have been assigned as its cause, are the only ones. But, says Beer, it should be remembered, that, in these cases, children with worms are often scrophulous; and adults, who are troubled with acidities in the stomach, are frequently gouty; while other patients, who complain of dyspeptic symptoms, may labour under hysteria, hypochondriasis, or infarction, obstruction, or actual hardness of one or other of the abdominal viscera, whereby this amaurosis, or even a mere weakness of sight, is often rendered incurable, and made to degenerate into complete blindness.

When the case is uncomplicated, the cure is easy enough; for, with regard to foul acidities in the stomach, Beer has never found it necessary, in the earliest stage, to prescribe any thing but absorbent medicines, which are to be followed by a long careful employment of light, tonic bitters, joined with the spiritus ætheris nitrici. In the second form of the complaint, the frequent drinking of a large quantity of warm water was often found of itself effectual, to remove both the general disorder, and that of the eye, a very gentle vomiting being thus excited, without straining, and the stomach completely freed from what was the source of indisposition. When the saburræ have a tendency to be discharged upwards, as indicated by continual nausea and disposition to vomit, emetics, which never operate without some violence, are to be most carefully avoided in plethoric individuals, or those who have a manifest determination of blood to their heads and eyes, or any acceleration of the circulation. The caution, here given, must be observed, even though emetics may on other accounts seem advisable; and, according to Beer, the determinations of blood and the state of the system here mentioned, are commonly attendant upon this species of amaurosis. Indeed (notwithstanding the testimony of Schmucker, Richter, and Scarpa,

in favour of emetics in this case) Beer positively affirms, that the violent operation of an emetic frequently converts this sympathetic amaurotic weakness of sight all on a sudden into blindness. Although I apprehend that Beer may here be somewhat prejudiced against emetics, candour obliges me to add, that, in this country, their efficacy in the present disease is by no means equal to the representations of Richter and Scarpa. When there is less tendency to vomiting, but the case is attended with an oppressive sense of weight about the stomach, frequent eructations, as if arising from rotten eggs, an inflated belly, and tense hypochondria, a gentle aperient clyster may be ordered, especially when the bowels have been for some days confined, in which circumstances Beer has found, that tolerably brisk purgatives are always of the greatest service, both in regard to the general complaints, and the amaurotic weakness of sight; the removal of the offensive matter from the alimentary canal being immediately followed by a cessation of the determinations of blood already mentioned. Lastly, when this amaurosis originates altogether from the presence of worms in the bowels, common anthelmintics are to be prescribed. In all these cases, says Beer, mere local treatment is quite inapplicable, and may do mischief. (*Beer, Lehre von den Augenkr. B. 2, p. 517—21*;) yet, as I have already explained in the foregoing pages, Scarpa and Richter here again differ very materially from this experienced oculist.

5. Of the amaurosis, from the recession of acute cutaneous eruptions, as described by Beer.

The peculiarity of this amaurosis is, that it comes on very rapidly, and always at that period of scarlatina, the measles, and less frequently the small-pox, when these contagious eruptions do not come out completely, but, from some cause or another, are suddenly repelled. This affection of the eyes, however, does not always induce perfect blindness. The pupil is invariably found preternaturally contracted, but quite transparent; the iris motionless; its pupillary edge however regularly shaped; while no characteristic appearance, like a palpable turgescence of the blood-vessels of the conjunctiva, is present. In a note, Beer remarks, that, although this amaurosis is not characterized by any particularly striking peculiarities of appearance, the diagnosis, especially in such children as can speak and complain of the considerable diminution or entire loss of their sight, is facilitated by the existing general exanthematous disorder; and, the more so, as the affection of the sight almost always commences with rapidity in the first stage of the eruption.

In respect to the causes of this amaurosis, Beer remarks, that, if the sudden check of the eruption does not always produce such impairment of sight, but much more

commonly ophthalmy, the explanation is, that, in children, one circumstance, essential to the origin of amaurosis, is frequently wanting, viz. a directly or indirectly formed considerable weakness of the immediate organ of vision, that is to say, of the optic nerve and retina. The production of amaurosis by the recession of eruptions, is a circumstance in which I could never put implicit reliance; and here we find Beer himself compelled to associate with the explanation a previous weakness of the eye. With the above few, but unfavourable appearances in the eye, the prognosis is hopeful, if proper assistance be given without delay, that is to say, before the exanthematous disorder has quite ended. But, when the latter indisposition has terminated, and the amaurotic blindness yet remains, or when the impairment of sight has already existed a long while, an attempt to cure the patient may indeed be made, but, as far as Beer's experience goes, the chance of success is very small.

When the eruptive stage of the general disorder is not past, the indication is to promote, by every possible means, the coming out of the eruption. For this purpose, Beer recommends sudorifics in general, camphor, the warm-bath, &c. And, when the surgeon first sees the patient in a later stage of the exanthema, the same remedies may be tried, though the result will be more uncertain; and in the ultimate period of the general affection, there is a necessity for employing, together with these remedies, various alterative medicines. Local means, applied directly to the eye, are always hurtful, while the constitutional illness lasts, and afterwards are, at the best, only useless. When the eruptive disorder is completely gone, but the amaurosis continues, alteratives may be of service, and in debilitated subjects they should be combined with the calamus aromaticus, (sweet-flag) and camphor, or bark. In this stage, also, the excitement of some counter-irritation is absolutely requisite. On the continent this is sometimes done on the arm with the cortex mezerei; but it is a better practice to rub antimonial ointment alternately behind the ear, and upon the nape of the neck, so as to maintain for a sufficient time an itch-like breaking out upon the integuments. (*Beer, Lehre von den Augenkr. B. 2. p. 523—25.*)

6. Of the rheumatic amaurosis.

According to Professor Beer, the rheumatic amaurosis is not very uncommon, and is so plainly denoted by symptoms, to which we shall hereafter advert, that it cannot well be mistaken; namely, a perfectly clear pupil wavers in the midstate between contraction and dilatation, the iris seeming to be nearly motionless; the eyes weep from the slightest causes, and constantly betray more or less aversion to light; the case is invariably attended with wandering, irritating pains, sometimes affecting the eyeball itself, sometimes the vicinity of the eye, and, in other instances, the teeth or

neck. Also, when both eyes are affected together, which is not regularly the case, a cast of the eye, which cannot be called actual squinting, may be remarked, and frequently the motion of the eyeball is chiefly obstructed only in one direction, though sometimes a true obliquity of the organ exists: (*husctas*.) In nearly every instance, there is considerable weakness of the levator muscle of the upper eyelid, and, not unfrequently, a complete blepharoplegia; but total blindness is seldom produced.

According to Beer, this amaurosis, which is to be considered as chronic rheumatism, often arises from keeping the head long exposed to the air, and is chiefly met with in individuals, who, while sweating profusely from the scalp and brow, in warm weather, have taken off their hats, and remained with their heads a long while uncovered. As, however, in warm weather, the generality of persons expose themselves in this manner, and few are attacked by amaurosis, I infer that something more is requisite for the production of the disease.

Under certain circumstances, the prognosis is by no means unfavourable; and hitherto Beer has mostly succeeded in effecting a perfect cure when the amaurosis was not completely formed; not of very long standing. The patient had no tendency to gout; and when, during the treatment, every thing was avoided that was likely to bring on an attack of that disease. Experience proves, however, (says Beer,) that if the patient be not cautious, the disease be neglected, or the least disposition to gout prevail, this amaurotic impairment of vision may change into a complete gouty amaurosis, just as rheumatic ophthalmia may be converted into gouty inflammation of the eye.

In this amaurotic weakness of sight, the treatment consists not simply of local means, which indeed are always needful, but likewise of general remedies. With regard to the latter, Beer assures us, that manifold experience has convinced him of the preference which ought to be given to the extract of guaiacum, joined with camphor, and given alternately with the compound powder of ipecacuanha; which remedies, as soon as the wandering pains about the eye and eyebrow begin to be milder, and more fixed to one part, are to be succeeded by the extract of aconitum, antimonial preparations, and flowers of sulphur. Externally, the most powerfully operating means are not to be omitted, especially blisters applied successively behind the ears, to the temples, and eyebrows; and as soon as the pain has completely subsided in these last parts, and is perhaps more concentrated in the eye, frictions are to be made on the eyebrow with liniments, containing at first a moderate quantity of opium, and afterwards of the extractum conii. At length, when the pain in and about the eye is nearly subdued, but some degree of amaurotic weakness of sight is left, frictions with naphtha, and a small por-

tion of tinctura lyttæ and tinctura opii, will be found exceedingly beneficial. Afterwards, when a considerable time has transpired, without the recurrence of the slightest rheumatic pain in the eye, its vicinity, or the head, but the eyesight is not perfectly re-established by perseverance in the above general and local treatment, and especially when the paralytic affection of the levator of one or other of the upper eyelids continues, (as often happens,) galvanism may be tried, with the cautions elsewhere premised. (See *Gutta Serena*.) And in the most desperate cases, Beer approves of making an issue in the depression between the angle of the jaw and the mastoid process, and keeping it open for a fortnight after the recovery seems complete. (*Lehre von der Augenkr. B. 2, p. 526—29.*)

7. *Of the amaurosis, which proceeds from the stoppage of a catarrh, without any actual collection of mucus in the frontal sinus.*

In this instance, as Beer observes, the circumstances of the pupil becoming very much dilated, yet retaining all its wonted transparency, the iris being motionless, and its pupillary edge not regularly circular, but angular, will not form any criterion, because these morbid appearances are common to several forms of amaurosis. But, the constant projection of the margin of the pupil into an angle directed towards the temple, whereby the pupil is also inclined more towards the external, than the internal canthus, is a peculiar mark of the case, and as difficult of explanation as the displacement of the pupil towards the root of the nose in what Beer and others consider as syphilitic iritis. The patient also complains of the eye being unusually dry; of a sensation of particular fulness in it; of a very troublesome dryness of the nose on both sides, even though the amaurosis be restricted to one eye; and his feelings are constantly those of a person who is in a dusty room.

These subjective symptoms (says Beer,) are conjoined with an amazing heaviness about the root of the nose, and a shooting pain in the head, extending from the region of the frontal sinus outwards to the temple, and upwards to the top of the head. This case of amaurosis, however, never terminates in complete blindness, though the impairment of vision may attain a degree which approaches the latter state. The diagnosis will be materially facilitated by an inquiry into the history of the disease, when it will be found, that the affection of the sight followed the sudden stoppage of a violent catarrh.

According to Beer's experience, when an abundant discharge of mucus from the nose can be excited (which mode of treatment, however, requires the greatest caution, lest it do more harm than good,) there are few cases of amaurosis, in which the prognosis is as favourable as in the present example. The indication is to reproduce, as quickly

and as freely as possible, the secretion of mucus from the nose; but this object is not to be at once attempted with the most powerful sternutatories; for (as Beer can affirm from his own experience) such treatment is apt to fail, and do more injury than benefit to the eyesight. This eminent practitioner inculcates, therefore, the propriety of first preparing, as it were, the Schneiderian membrane for the operation of the stronger mechanical, chymical stimulants, which, he says, may be best done, first, by letting the steam of warm water be directed up the nostrils; secondly, by inhaling into the nose warm emollient, mucilaginous decoctions, especially the decoction of mallows; and, lastly, by employing in the same way a warm weak solution of manna in milk. Yet, says Beer, even with these applications, one must proceed with caution; for, when they are made too strong, the headach and weakness of sight are almost instantly augmented. At most, half a scruple of manna canellata is to be dissolved in from four to six ounces of milk; and for children and irritable females, the mixture should be still weaker. When preparation has thus been made, that is, when the mucous membrane of the nose is rendered soft and somewhat tumid, when the dryness of the nose is in some measure lessened, when the patient feels as if his nostrils were constantly filled with thick mucus, which he endeavours to get rid of by blowing his nose; when the sense of heaviness about the root of the nose increases, and the violent headach changes into a dull heavy feel; the precise crisis has arrived when great benefit may be derived from the powder of mild aromatic herbs, blended with a small proportion of calomel. After this has been employed some time, brisk sternutatories may be tried, like those composed of aromatic vegetable powders mixed with black hellebore, or the vapour of strong volatile smelling salts, caustic ammonia, &c. These means frequently bring about a profuse discharge of thick fetid mucus, after which evacuation the disagreeable sensations about the root of the nose, and eyebrow, gradually cease, the nose is left moister than usual, and the eyesight is at length completely restored. The only thing, which it is necessary for the patient most strictly to avoid, during the whole of the treatment, is the cold air, exposure to which (according to Beer's observations) may be the means of frustrating every endeavour to complete the cure. (*Beer, Lehre von der Augenkr. b. 2, p. 530—34.*)

2. Of the genuine paralytic amaurosis.

This is not an unfrequent case: it always originates very suddenly, attended with a manifest contraction of the pupil, which opening has not lost any of its natural clearness; and there is complete immobility of the iris, the pupillary margin of which does not present the slightest irregularity. However, either some muscle of

the globe of the eye, the levator of the upper eyelid, or the orbicularis palpebrarum; nay, several of these muscles, and sometimes all of them together, are affected with paralysis; while the blindness itself is almost always not only complete, but not unfrequently so complete, that every vestige of sensibility to light is lost. The functions of the puncta lachrymalia are also more or less impeded, whence a greater or lesser degree of epiphora usually accompanies the disorder, as a natural effect of the abolished, or diminished absorption and conveyance of the tears into the lachrymal sac; circumstances generally occurring whenever the orbicularis palpebrarum is paralytic. A completely amaurotic eye of this description, says Beer, has the greatest possible resemblance to a dead eye. When all the muscles of the globe are palsied together, the eye can no longer preserve its situation in the orbit, but protrudes, as it were, lifeless (*Ophthalmoptosis paralytica*;) while the whole tunica conjunctiva is commonly oedematous, or very blood-shot; and, it is not unusual to find this amaurosis conjoined either with paralysis of certain muscles of the face, or even with hemiplegia.

The causes of the true paralytic amaurosis comprise violent concussions of the eyeball itself, unaccompanied with any solution of continuity, or any displacement of the internal parts of this organ; concussions of the upper and lower margins of the orbit, especially the eyebrow, and neighbouring part of the forehead, without any laceration of the frontal and infraorbital nerves; and concussions of the whole brain, or spinal marrow: sometimes, however, the disorder is only a symptomatic effect of apoplexy. In the three latter cases, the blindness regularly extends to both eyes.

The prognosis may either be very favourable or unfavourable. When the amaurosis is only the momentary consequence of a simple concussion of the eyeball, without any breach in its internal texture, if the retina be not wounded, and none of the inner parts of the eye displaced, the case always admits of a perfect cure by proper treatment; and, says Beer, it is incredible how much may here be accomplished, by beginning the treatment judiciously, even when the eyesight has been nearly or quite abolished, and the concussion of the eyeball has been so serious, as to produce an effusion of blood in the chambers of the aqueous humour. Beer owns, however, that cures of the latter description, of which the ophthalmic hospital at Vienna has afforded many examples, are only to be considered as extraordinary occurrences, and therefore should not form any general inference for the prognosis. But, when this amaurotic loss of sight is the effect of a severe concussion of the brain or spinal marrow, and the case is unequivocally denoted by its general well-known characteristics, and its history; or when the dis-

order is the symptom of an apoplectic fit; the prognosis is very unfavourable, not merely with respect to the restoration of sight, but the patient's life itself.

In cases of paralytic amaurosis, even where it proceeds from a concussion of the eye itself or its vicinity, a complete cure cannot always be expected from merely local remedies. The treatment, however, should regularly begin in this manner, and the surgeon first try whether it will answer or not. For this purpose, Beer particularly recommends the employment of all those nervous remedies, the cautious gradual use of which in the empirical treatment of amaurosis is particularly praised by that author. (See *Gutta Serena*.) Should local means fail, gradual recourse must be had to antiparalytics and tonics. (*Lehre von der Augenkr. B. 2, p. 535, &c.*)

9. Of the symptomatic amaurosis from hydrocephalus.

According to Beer, this amaurosis may occur, as a symptomatic effect, not merely in internal hydrocephalus and collections of water in the ventricles of the brain, but also in external hydrocephalus and spina bifida. In the two latter cases, the diagnosis is easy; but, in the two first, it is more obscure, though it may generally be made out by attention to the following characteristic symptoms. The perfectly black, clear pupil is very much dilated; the iris is completely motionless, its pupillary edge forming here and there a very small, hardly distinguishable angle; the amaurotic eyes, (for they are constantly both affected,) are either prominent and fixed in a lifeless way, the muscles of these organs evincing little propensity to contract, or they are in a state of continual oscillation in various directions, never, however, in the line of the straight muscles; but the appearance is rather as if there were an incessant struggle between these last and the oblique muscles. In the sclerótica around the cornea, an extraordinary bluish tinge may be noticed. Children never hold their heads up, but incline it to one side or the other; and, if they are old enough to walk, they tread very insecurely, hobble along, and frequently tumble down. Lastly, the os frontis projects in a remarkable degree, and the child, completely bereft of vision, at length dies with convulsive, or apoplectic symptoms.

The cause of this amaurosis, which is merely a symptom, depends upon the principal disease, namely, the hydrocephalus, and it would appear, indeed, that the blindness, which does not accompany every case of internal hydrocephalus, is particularly attendant upon collections of water in the ventricles. And Beer informs us, that, in two cases, in which he saw this amaurosis as a symptomatic effect in spina bifida, he found, after death, a prodigious quantity of water in all the four ventricles.

As hydrocephalus, especially the internal species, and collections of water in the ven-

tricles, are almost always incurable, it is plain enough what expectation can be entertained of a recovery of the eyesight. Yet, when the amaurosis is truly a symptom of water in the ventricles, the stage of the disorder is known, and the practitioner has not been consulted too late, something may yet be done, as Beer has learnt from experience. The surgeon, however, will rarely be able to render any benefit, because his services are usually not required until the last stage, and it only remains for him to foretell the melancholy fate both of the patient's eyesight and life. In the very uncommon case of amaurosis, which is a symptomatic effect of external hydrocephalus, if the health be not too much reduced, there is always more hope.

Medical treatment will sometimes do good, if not administered too late. The period, when the oculist is consulted, says Professor Beer, is never that in which inflammation of the brain exists, and, whatever good can now be done, is generally to be done with calomel and digitalis. (See *Lehre von der Augenkr. B. 2, p. 539—41.*)

Beer's Fourth Species of Amaurosis and its Varieties.

1. Traumatic amaurosis.

Beer applies the epithet *traumatic* to such cases of amaurosis as are the consequence of a considerable wound of the eye itself, its surrounding parts, or the skull. Here consequently is first arranged the amaurosis produced by laceration and stretching of the branches of the frontal nerve from irregular scars about the eyebrow. Secondly, Beer reckons the amaurosis arising from external violence, directed in such a degree against the upper or lower side of the orbit, that the retina is torn, and many of the internal softer textures of the eye forced out of their natural situations. Thirdly, Beer includes every weakness of sight, or perfect amaurosis, which is the result of such injuries of the eyeball itself as extend to the retina, so as either violently to bruise or lacerate it, or cut or pierce it. For the prognosis and treatment of all these cases, he refers to his observations upon ophthalmy. Nor does he choose here to treat of the perfectly complicated amaurosis, which is a direct consequence of a coup-de-soleil, because it never happens unpreceded by a violent general inflammation of the eyeball, and therefore is to be regarded as an effect both of the injury and the inflammation together; but which like the symptomatic amaurosis, which follows common and genuine internal ophthalmy, may be easily known by the total insensibility to light, and the evident changes in the texture and shape of the eye; and is quite as incurable as the other example, to which we have alluded. (*Lehre von den Augenkr. B. 2, p. 542.*)

2. Gouty amaurosis,

Which, according to Beer, is so frequent

at Vienna, that it may be accurately observed in all its stages, plainly assumes two forms, the peculiarities of which probably depend more upon constitutional than external causes.

The first form or degree of the complaint is characterized by a very considerable dilatation and angular displacement of the pupillary edge of the iris towards the canthi; a continually increasing slowness in the movements of the iris, and final immobility of this organ; an actual change of colour at both its circles; a dull, glassy blackness of the pupil, and even a tarnish in the lustre of the cornea; an alternate appearance of the gray and black cloudy substances, described in the account of the general symptoms of amaurosis, which effect lasts while the patient is not totally blind. The disorder is further indicated by a fleeting, wandering, irritating, yet not very severe pain, all about the vicinity of the eye; a manifest tendency to a varicose enlargement of the blood-vessels of the conjunctiva and sclerotica; a very transient melioration of sight after meals, or any accidental excitement or stimulus; a considerable temporary decrease of it after the operation of any causes, which depress the spirits; the excessively slow formation of the disease, for which several years are usually required; and, lastly, by the nature of the patient's constitution. For, in general, this amaurosis (if we are to believe Professor Beer) always attacks both eyes at once, and is confined to fanatic, dark-eyed women, and very irritable, slender, weak, maiden females, who either have suffered from scrophula in their childhood, or from severe acute or chronic diseases at a later period of their lives; who are not yet far advanced in years; and whose menses have never been very irregular, though profuse. This form of amaurosis is restricted to no particular classes of society; it is not, however, so commonly noticed in the higher orders; while it is most frequent in the working middle classes, and scarcely ever remarked in the lowest ranks, especially country people.

It is remarked by Professor Beer, that, although the second form of gouty amaurosis makes its attack upon males, as well as females, the latter, on the whole, are most frequently affected, particularly about the period when the menses cease. This amaurosis, which is seldom formed quickly, that is to say, in a few weeks, or months, but mostly requires years for its production, begins with cloudy, indistinct vision; an appearance of different colours before the eyes; and a peculiar sensation as if insects were crawling over the skin around the eye. The pupil becomes manifestly dilated, and presents a dull greenish-gray colour, which, however, is easily distinguished from the colour seen behind the pupil in the amaurotic cat-eye, and plainly depends upon some defect in the vitreous humour, (*glaucoma*.) Also the iris, the pupillary edge of which is drawn towards both angles of the

eye, as in the first form of the disorder, undergoes an obvious change of colour, first at its lesser circle, which becomes of an uncommon dark hue, and then at its greater circle. The alteration of colour here spoken of, certainly proceeds from a general varicose state of the blood-vessels of the eye, which affection daily augments, and is attended with vehement pain in the organ and surrounding parts, or even in the whole head, or one side of it, whether the blindness attack one or both eyes together. This violent pain, however, which is such as often to distract the patient, is unsteady and irregular, being immediately aggravated by every violent mental emotion, whether of the exalting or depressing kind, every sudden and considerable change of temperature, every quick accession of wet cold weather, or when the patient stays only for a short time near a very heated fireplace, lies on feather pillows, with the affected eye resting in the depression of such a pillow, or covered with flannel, or he has been eating any indigestible food. It is very remarkable, that these attacks of pain subside without any medical assistance, in the dry warm season of the year, and in a mild, not too hot climate, are often kept off for several years. Upon every such attack of gouty pain, the glaucoma becomes more evident, the pupil larger and more angular, and the eyesight perceptibly weaker. At length, during one of these painful exacerbations, vision is completely abolished, not the least sensibility to light remaining; and the pupillary edge of the iris, together with the lesser circle of the same organ, then entirely disappears, being inverted towards the lens. The cirsophthalmia also gets so much worse, that the sclerotica acquires a smutty grayish-blue colour; and at length, the bluish windings of vessels may be noticed at various points, particularly about the place where the tendons of the muscles are affixed. Afterwards the green, or what may be more properly called, the glaucomatous cataract, is manifestly developed, and the eye then generally wastes under the most violent attacks of pain. The light, which the patient always thinks he sees, but which, according to Professor Beer, is produced of a reddish or bluish colour in the interior of the eye, like galvanism, keeps up the hope of recovery; but, all consciousness of this luminous appearance ceases as soon as the eye begins to waste. The first degree of gouty amaurosis readily changes to the second, especially in persons who are getting into years, or are near the period of life when menstruation terminates.

That in amaurotic patients of the foregoing kind, a certain morbid tendency to gout exists, may be inferred from what has been already said of the peculiarities of constitution which are noticed. In such individuals, therefore, it is not extraordinary, that the first degree of gouty amaurosis should originate, and almost uninterruptedly augment to complete blindness, while

certain general and local causes are incessantly operating upon the eyes; such as long grief affecting a very sensible mind; excess in wine; sleepless nights, occasioned by care or fear; straining the eyes, either by too much reading, particularly at candle-light, or by any of the fine kinds of work usually done by women; bad, unwholesome sorts of food; and want of good air, and proper exercise.

The causes of the second form of gouty amaurosis, says Beer, are the same as those of gout in general, which, however, are very imperfectly known. Whatever in certain individuals has the effect of promoting, or actually bringing on an attack of gout, may excite this amaurosis, especially, when at the same time hurtful or debilitating circumstances are affecting or have been affecting the eyes. It is to be recollected, however, says Beer, that just in the same manner as few of the individuals, exposed to the influence of these last circumstances, are attacked with gout, so few gouty subjects are afflicted with this amaurosis, and, consequently in both cases, a certain predisposition to such disease, already existing in the eyes, seems essential to its production. According to Beer, such individuals as have been afflicted with scrophula or rickets in their youth, are very liable to gout, when they grow older; and, says he, gouty disease more frequently attacks dark, brown, or black eyes, than eyes of a light colour, especially when they have been much debilitated in the earlier part of life by immoderate exertion.

In the first degree of gouty amaurosis, Beer observes, that the slightest glance at the etiology of the case must show, how unfavourable the prognosis is; for, notwithstanding the disease frequently requires many years to be completely formed, and the causes are by no means so obscure, as in the second degree of the disorder, yet, they are generally such as absolutely cannot be removed, because interwoven, as it were, with the constitution. In fact, the surgeon being hardly ever able to check, much less cure, the blindness, is usually obliged to be an inefficient spectator of its progress. According to Beer, the apothecary's magazines contain no remedies, which are adequate to the cure of this amaurosis. A total change of the whole constitution would be requisite, ere success could be expected, and such change it is not in the power of physic to accomplish. The practitioner may give advice, and make the attempt; but, notwithstanding every exertion, the patient usually falls into a state of complete and irremediable blindness. In one example only Beer has succeeded in checking the disease, by persuading the patient to observe a strict regimen, not a grain of medicine being given; but the patient still remains weak-sighted, though various medicines have latterly been tried.

The following are Beer's observations on the prognosis in the second stage of gouty

amaurosis. If in the first stage, there is scarcely any hope of preserving the sight, where the causes of the disease are apparently known, how little expectation of success can be entertained in the second stage, where the causes are involved in perfect obscurity, and are probably in some measure dependent upon a propensity to gout existing in the constitution from childhood. Indeed, when the patient is living under the influence of such circumstances, as are known to promote gout, certain blindness may be predicted. The same termination may also be foretold, without any chance of error, when glaucoma is evidently present; and, though a weak power of vision be yet left, this will soon be forever lost. It is doing a great deal in these cases to free the patient from intolerable pain, and, by active resistance to gout, perhaps, still preserve the other eye, where this is not yet affected, or not in a serious degree. But if the practitioner find, when he is first consulted, that the green or glaucomatous cataract is already formed, there is then not the slightest chance of obviating the pain, which ordinarily continues, until the eye is completely wasted away, and the fissure of the eyelids has permanently sunk in the orbit and closed.

With respect to the treatment of the second stage of gouty amaurosis, Beer observes, that it should be like that of gouty iritis. In particular, attention must be paid to the attacks of pain, and palliative means adopted. The patient should not lie upon feather beds, nor especially feather pillows, but only employ articles of this kind, which are stuffed with horse hair. Neither must he expose himself to an atmosphere, which is at the same time both cold and damp; and, if he cannot altogether take care of himself in this respect, at all events let him keep his head and feet warm and dry; shun every thing which tends to impede the functions of the skin; and avoid pork-meat, every thing cooked with hog's lard, and very acid salt dishes, like herrings. With what are usually considered as gout-medicines, the practitioner should act very circumspectly; and, as in gouty iritis, he should pay close attention to the state of the constitution, rather seeking to afford relief by means of a well-regulated diet than by the employment of much physic.

With arthritic amaurosis, says Beer, is to be classed an amaurotic, rapidly formed, complete blindness of both eyes, which is the immediate result of a sudden violent fright; but only takes place in such individuals as are excessively nervous and irritable, and more or less prone to or actually affected with gout. The most striking effect, which characterizes this consequence of arthritic amaurosis, is that change, which is instantaneously produced in the structure and form of the eye at the moment when the patient recovers from his fright, and comes to his senses again, of which defects in the interior structure and form of the eyes there was not previously

the smallest vestige, and these organs, if not quite healthy, could only be termed weakish. These changes are indicated by a considerable dilatation of the pupil, which is drawn into an angle upwards and downwards; by the complete immobility, and the projection of the iris towards the cornea; by the manifest appearance of vessels fully distended with blood, on the greater circle of the iris; by all the symptoms of a beginning glaucoma; and by a general varicose affection of the blood-vessels: which two latter effects from this period incessantly continue, attended with violent pain in the head and eyes. (*Lehre von den Augenkr. B. 2. p. 544, &c.*)

3. *Of the amaurosis occasioned by the sudden cure of particular cutaneous diseases, and of old ulcers of the leg.*

Most of the cases, which appertain to this class, are said to have a great resemblance to the second form of gouty amaurosis. According to Beer, when psora, porrigo, old ulcers of the leg, &c. are suddenly healed, a consequence more frequent than amaurosis, is a sympathetic ophthalmia, which indeed may easily be removed by judicious treatment, but, if unskilfully managed, may prove very obstinate and dangerous. This eminent oculist thinks, that, in children, amaurosis is very rarely produced by the indiscreet cure of crusta lactea, and, with one single exception, the blindness has appeared to him to be a symptomatic effect of water in the ventricles of the brain, formed (as he perhaps too credulously supposes) in consequence of the injudicious repulsion of the cutaneous disorder.

When this amaurosis assumes its ordinary form, Beer has not yet been able to remark in it any peculiar characteristic symptoms, by which it can be effectually distinguished from the second form of gouty amaurosis, excepting, first, that it originates and increases very suddenly, while the true arthritic amaurosis is a long time, and for the most part several years, in forming. Secondly; that at its commencement it is never attended with violent pain in the eyes, or head. Hence, the diagnosis will depend very materially upon a correct recollection of circumstances. But, according to Beer, there are some cases, in which, besides the complete blindness, unattended with the slightest power of perceiving light, there is no characteristic symptom, but extraordinary enlargement of the pupil, total immobility of the iris, and an inanimate projection of the eye.

Respecting the causes of this amaurosis, Beer says, that he has nothing important to offer. He owns, that after the sudden cure of certain cutaneous diseases, and of old ulcers of the legs, an amaurotic blindness does not always ensue; and he believes, that the reason why the bad effects take place in other organs, sometimes the brain, the lungs, or the bowels, &c. may probably depend upon this or that organ happening to be most predisposed to disease. Here

the discerning reader will not require me to point out to him, that such a mode of accounting for things is entirely hypothetical, and destitute of proof: it is indeed so convenient a sort of explanation, that it admits of being extended to all diseases, without exception. If we are to believe Beer, the prognosis is very uncertain, and, in many cases, highly unfavourable; first, because an organic part, namely, the optic nerve, is directly affected, which by the operation of external and internal causes, is soon rendered unfit for the performance of its functions. Secondly; because, in the majority of examples, important changes immediately take place in the organization of the whole eye, which are particularly difficult of removal, when the nervous textures are affected. Thirdly; because it is impossible to know, whether morbid changes may not already exist in the retina, or course of the optic nerve.

In the treatment, Beer, who places implicit reliance upon the above statement of causes, is an advocate for reproducing, as quickly as possible, the original disease, and, if that cannot be done, he thinks some artificial disease should be formed in lieu of it. For these purposes, he often employs blisters, and friction with antimonial ointment. What, however, is likely to be ridiculed in this country, his treatment, where amaurosis happens to follow the cure of itch, consists in inoculating the poor patient again with psoric infection, as if it were not more tolerable to remain blind than live perpetually scourged with the other disorder; for the Professor's theory leaves us uninformed of the circumstances, under which the patient whose sight is restored by this expedient, could ever venture to have a sound skin again, without the risk of a fresh attack upon his eyes. But, it seems even from Beer's account, that the patient's subjecting himself to the itch will not always cure his eyes; for, says Beer, when this method fails, friction with antimonial ointment should be tried.

When amaurosis follows the healing of old sores, Beer recommends the formation of them again by applying to the cicatrix strong mustard cataplasms, and the muriate of soda; and, if the new ulcers cannot be made to discharge properly, he praises the application of issues to the calves of the legs, and, in urgent cases, to the thighs. These plans are to be aided by such medicines, as act specifically upon the skin, like antimonials, especially the sulphur auratum antimonii: Beer also speaks favourably of sulphur baths; and, in cases complicated with debility, administers tonics, particularly the calamus aromaticus and bark. (*See Lehre von den Augenkr. B. 2. p. 556—63.*)

4. *Of amaurosis, as the immediate consequence of a violent fit of anger, which has been kept under with difficulty.*

This case, which is described by Professor Beer as one of the most uncommon

forms of amaurosis, begins at once with a very considerable enlargement of the pupil, without any sensible angles in the margin of this opening, but with complete immobility of the iris; a thick plexus of dilated blood-vessels in the conjunctiva; a red yellowish colour of the whole sclerotica; and, usually, a greater or lesser degree of a suddenly formed jaundice; a slight turbidness of the aqueous humour, and complete loss of sight in one, or both eyes, yet without all sensibility to light being abolished. It is not uncommon for the case to be combined with hemiplegia, in which event, only one eye, namely, that on the paralytic side, is entirely blind, while the other is simply weakened; or there are merely signs of paralysis observable in the parts around the eyes, the muscles of the face, or even in organs at a greater distance from the eyes, in which event, vision is impeded in both eyes.

In amaurosis in general, there is often a peculiarity of constitution clearly concerned in the production of the disease, and this seems here to be the case; for, says Beer, "though I have not met with many examples of the present kind, and have had the treatment of still fewer, the patients, whom I have seen, were all very choleric, and bilious, and had dark-brown or almost black eyes. In every case, the amaurosis began, and was formed in a moment, after the patient had been affected with violent anger, which was repressed with great difficulty, to which gusts of passion he was evidently very subject. Yet (adds Beer,) it should be remarked, that all these patients had been immoderately exerting their eyes in various kinds of employment, a little while previously to the attack."

The few opportunities, which Beer has had of seeing this form of amaurosis, incline him to regard the prognosis as very uncertain, especially when professional aid is delayed for some days or weeks, after the commencement of the blindness.

Beer represents the treatment as liable to equal uncertainty: twice he succeeded in effecting an immediate partial restoration of sight, by giving a gentle emetic. In three other cases, where he had not been consulted directly after the beginning of the attack, the emetic plan had no effect. In the two first cases, vision was re-established by long perseverance in the exhibition of arnica, joined with camphor, and in the use of sulphurous baths, by which means the hemiplegia was also removed. The other three patients however continued completely blind; nor could Beer render them any benefit, though he tried the whole catalogue of antiparalytics and antispasmodics. (*Lehre von den Augenkr. B. 2. p. 563—65.*)

5. Of the amaurosis, which follows the stoppage of a catarrh, with collection of mucus and matter in the frontal sinus.

Beer has had as yet the management of

only three cases of this species of amaurosis, which appears to be one of the least frequent forms of the disorder: in each instance, it was indicated by the following characteristic phenomena; though he acknowledges, that, in the first example which occurred, he was very uncertain about the diagnosis. Directly after the sudden stoppage of a violent catarrh, the patient experiences an oppressive, dull, continually increasing pain about the root of the nose and frontal sinuses, and, at the same time, a considerable amaurotic weakness of sight takes place, either in one or both eyes, attended with various luminous appearances; with a contracted, perfectly round, but palish-black pupil; complete immobility of the iris; a deviation of one eye from the axis of sight, when only one is affected; and of both eyes, when the affection extends to both of them. Hence, when the two eyes are open, the patient sees objects double. The case is also attended with weakness of the upper eyelid; great dryness of the nose; a constant sensation as if the nostrils were filled with dust; reiterated fits of sneezing come on, during which ugly transient luminous forms suddenly and rapidly present themselves before the eyes. When the disease is not understood, or it is neglected, the eyeball at length protrudes from the orbit outwards and downwards, in which state the pain in the frontal sinuses becomes irregular, but more severe; the eyesight continues to grow decidedly worse; and, from this period, the patient not only discerns all objects very feebly, but in an imperfect misshapen manner. At length, the front of the sinus not only projects forwards, but forms a swelling, which has the softness of cartilage, in which stage, vision is quite abolished, and all sensibility to light is destroyed.

With respect to an explanation of the manner, in which the alleged cause of this form of amaurosis operates, Beer is more reserved than on some other occasions, and declines offering any hypothesis: he merely states his belief, that actual inflammation within the frontal sinus has a principal share in bringing on the blindness.

As for the prognosis, Beer thinks that some hope of the recovery of sight may be entertained, when vision is not already completely gone, and, in particular, that this benefit may be expected from judicious treatment, when the objects, which the patient is yet capable of discerning, have not a perverted, false, deformed appearance. On the contrary, nearly every hope is past, if all sensibility to light is not only quite annihilated, but the eyeball more or less pushed from its socket by the distension of the frontal sinus.

With regard to local treatment, if the case be not too far advanced, the indications and remedies are here exactly the same as those recommended in speaking of a former case of amaurosis from the sudden stoppage of a catarrh. In the present instance, while the pain is violent and incessant,

sant, there is still greater necessity for avoiding all irritating means, on account of the inflamed state of the frontal sinus. Therefore, in the early stage of the disease, when the pain is violent, and when during its prevalence the blindness threatens to augment rapidly, leeches should be applied to the temple, and if there be any symptomatic fever, a moderate general antiphlogistic treatment ought to be adopted.—When the pain about the root of the nose and frontal sinus has considerably declined; when it has become dull and irregular; when the mucous membrane of the nose is moist, soft, and tumid; when the patient feels disposed to blow his nose every moment, and he can do this without at all increasing the pain in the frontal sinus, or eye itself; then the first opportunity has arrived for the use of stimulants, recommended in speaking of the amaurosis from suppressed catarrh. They are to be employed, however, with the utmost caution. Blisters are to be laid on the eyebrow, and afterwards liniments rubbed upon the same part, and about the root of the nose, such as spiritus camphoræ, naphtha, and tincture of opium. Internal alteratives should likewise be ordered, especially arnica, conjoined with guaiacum, and camphor. When by this local and general treatment no discharge of mucus is obtained from the nose, and the symptoms are not materially lessened; but, on the contrary, the eyeball commences to protrude from the orbit; or, should this change already have happened, together with a projection of the anterior parietes of the frontal sinus; then, if this portion of the skull be yet firm and unyielding, there is no other resource left but that of making a perforation into the sinus with a small trephine; or, if the bone be soft enough, the opening may be made with a common perforator. In this manner, an outlet is formed for the mucus and matter collected in the sinus, to which cavity any requisite applications may now be directly made. Beer says, the case is now to be treated as an ill-conditioned ulcer, and he asserts, that it may sometimes be proper to destroy altogether the mucous membrane, which lines the sinus; a proceeding which I have great difficulty in supposing to be correct. If the surgeon defer making an opening too long, Beer says, that the eye is rapidly destroyed, and the mischief of the bones in the orbit extends so quickly from the orbital process of the frontal bone to the os ethmoides, os unguis, &c. that it is now difficult to put a stop to the ravages of the disorder. Beer informs us of one case, which he had under his care, where he trephined the frontal sinus, and every thing went on so favourably after the operation, that, in the end, no deformity was apparent, the eyeball returned into the orbit, and sight was restored. In a second example, also treated by the same author, after the perforation of the sinus, its lower part was found quite softened and carious: the treatment was consequently accommodated to

the diseased state of the bone. In this case Beer simply made and preserved a counter opening in the conjunctiva above the eye, the sight of which was already quite gone. In a third case, the accumulation of mucus and pus in the sinus was obvious; but the patient refused to submit to any operation, and, five weeks after Beer had been first consulted, the front of the sinus gave way, and, in the seventh week, the eye, the greater part of the orbit, and the bones of the nose, were destroyed, and the other eye completely amaurotic. (See *Lehre von den Augenkr. B. 2. p. 566—71.*)

6. *Of the sympathetic amaurosis in lying-in women, from suppression of the secretion of milk.*

This case is set down by Beer as one of the most uncommon varieties of amaurosis. It comes on rapidly, after sudden stoppage of the secretion and excretion of the milk, with violent headach, concentrated about the forehead and eyebrows; troublesome luminous appearances; an inconsiderable dilatation of the pupil; and scarcely any perceptible irregularity in the pupillary edge of the iris, which is quite motionless, somewhat altered in colour, and swollen. The disease is also accompanied with great aversion to light; a palpable turgescence of all the blood-vessels of the conjunctiva; a slight turbidness of the transparent media of the eye; and, at first, with a mere weakness of sight, which, in the end, suddenly changes into complete amaurotic blindness. The breasts, which before the attack were full of milk, are now empty, and hang down like bags, but are quite free from pain.

Beer is of opinion, that this form of amaurosis must be regarded as a true sympathetic effect, the cause depending upon the suppressed secretion of milk. This, says he, is proved, not only by the amaurotic blindness immediately following the stoppage of such secretion, but also by the method of treatment. It is acknowledged, however, that a further investigation of this part of the subject would be attended with great obscurity. As far as this eminent oculist can speak, from the few cases which he has had an opportunity of seeing, the prognosis is always unfavourable when the blindness is complete, and particularly when there is a manifest diseased change in the transparent parts of the eye; for, in the latter case, he has known patients remain perfectly blind, though the secretion of milk had been most successfully and expeditiously re-established. In one instance, the remedies applied to the breast, instead of reproducing the secretion of milk, excited in the part a painful inflammation and abscess, during which the weakness of sight subsided, though it was very considerable.

In considering other analogous cases of amaurosis, enough has already been said concerning the first and most important indication, namely, the re-establishment of the action which is obstructed; and here

the only question is, about the manner in which that object can be most expeditiously and safely effected. For, says Beer, it should be distinctly understood, that the prevention of a complete amaurotic blindness essentially depends not only upon the renewal of the secretion from the breasts, but upon this change being made without delay. The remedies, which Beer has found most effectual for this purpose, are warm poultices applied to the breasts, and at first composed of simple emollients, and afterwards of more stimulating ingredients, such as hemlock, camomile flowers, &c. When the breasts have more of a leucophlegmatic appearance, than that indicative of a fulness of the mammary gland, and disposition to a renewal of the milk-secretion, Beer strengthens these poultices with aromatic herbs, and applies them alternately with well-warmed bags, full of dry aromatic plants, and sprinkled with camphor. These last means are very useful at night, or when the patient is asleep, and fresh warm poultices cannot be put on sufficiently often. In the daytime, the breasts should be frequently and gently rubbed with warm flannels, medicated with oil-banum and mastic. This plan is to be followed up until the secretion and excretion of milk are renewed, and the amaurotic amblyopia has subsided. When the secretion either cannot be restored by the foregoing means, or the eyesight does not return with the re-established secretion, internal remedies must be tried, especially arnica, joined with calomel and camphor. Issues or setons should also be formed, and kept open for a considerable time. Such is the treatment by which Beer once succeeded in stopping the increase of this kind of amaurosis, though the result was not indeed what could be named a cure. (*Lehre von den Augenkr. B. 2, p. 572—75.*)

7. *Of the symptomatic amaurosis from morbid changes, either in the optic nerves, and their sheaths, or in the bones of the cranium, or the brain itself.*

Beer says, a very considerable number of cases of this form of amaurosis which have fallen under his notice, have enabled him, as it were, not only to know it at once, but to describe its exact symptoms. However, he does not mean to assert, therefore, that more minute circumstances may not yet exist, which have hitherto escaped his remark, and which may hereafter be detected by other diligent practitioners, so as to facilitate still more the diagnosis, especially in the early stage of the disorder. To an indefatigable observer many pathological examinations of such amaurotic eyes in dead subjects must occur under unfavourable circumstances, which examinations, if properly connected with a minute history of the cases, might lead to important conclusions, with respect to the causes of this very interesting, and not uncommon, species of amaurosis. The title of the present chapter embraces a great diversity of causes,

and the result, must necessarily be certain modifications of the disease. Beer then commences with a simple relation of the general appearances which always characterize this amaurosis.—1st, Its formation is constantly very slow, and in all cases the patient is not only completely deprived of vision, but, for more or less time previously to his death, is rendered quite incapable of distinguishing light. 2dly, A second peculiar symptom of this amaurosis consists in morbid changes in the structure of the eye, which changes are at first scarcely perceptible, and increase very slowly. 3dly, The amaurosis either originates during an attack of violent headach, which continues almost uninterruptedly until death, or the headach does not come on until complete blindness has taken place; or the patient may have no pain whatever either in his eyes, or head. 4thly, In the progress of this amaurosis, objects invariably seem to the patient to be perverted, disfigured, &c. which state of the eyesight is termed by oculists *Metamorphosis*.

Symptoms when the disorder proceeds from disease of the optic nerves, or their sheaths.

This case comes on slowly, and rarely attacks both eyes together. It always commences with a black cloud, which grows more and more dense; and with a troublesome, alarming perversion and disfigurement of every object, without the least painful sensation in the eye or head. The patient merely complains of a slight sensation of dull pressure at the bottom of the orbit, as if the eyeball were about to be forced from its socket, of which displacement, however, there is not yet the smallest appearance. In the very beginning of the disease, the pupil is already considerably dilated, and the pupillary edge of the motionless iris presents angles at several points, the pupil sometimes representing an irregular pentagon, or hexagon. By degrees, though very slowly, a glaucomatous change of the vitreous humour ensues, and afterwards of the lens itself, the only species of glaucoma which Beer has ever noticed quite unattended with a varicose affection of the blood-vessels of the eye. At last the globe of the eye becomes perceptibly smaller than natural; but a complete atrophy does not ensue.

Symptoms when the case proceeds from disease of the skull or brain.

In this form of amaurosis, which usually attacks both eyes together, or at least one very soon after the other, the blindness also commences very slowly, with appearances as if every object looked at were perverted or disfigured. However, there is no black cloud, but rather an obscurity or confusion of every object. The disease in this stage is also accompanied with frequent giddiness, ugly luminous spectra, and for the most part, with aversion to light, uncommonly lively motions of the iris, a contracted pupil, angles in the upper and lower portions of the pupillary margin of the

iris; an evident turgescence of the blood-vessels of the eye, gradually augmenting with most violent headach into actual cirsophthalmia; frequent convulsive motions of the eyes and eyelids, and strabismus of one or both eyes, ending in a true deviation of one or both these organs from their natural positions. Under these symptoms, vision is afterwards entirely abolished; and the headach, though subject to remissions, grows so much worse, extending back to the spine, that the patient is often nearly frantic, and, indeed, after a time, a destruction of the external senses happens, followed by that of the intellectual faculties. The first of the external senses which is lost, is always the hearing, which infirmity is next followed by loss of the smell, or taste, or both these senses together; and then the memory, and other intellectual powers decline. In this stage of the disorder, the eyeball not unfrequently protrudes from the orbit; a pathognomonic symptom, to which Beer attaches great importance, because it is an infallible criterion of a diseased state of the bones of the orbit, of the parts which invest this cavity, and of the optic nerve and dura mater, in the sella turcica. In such cases, complete mania now usually follows, and this sometimes in its most violent form, unless the patient happen to be first carried off by paralytic symptoms, life, under these circumstances, never lasting any considerable time.

As far as our external senses can discover, the cause of both these forms of amaurosis, as the title of this section specifies, lies in certain morbid changes in the structure of the optic nerve and its investments, or in diseased alterations of the bones of the cranium, the dura mater, and the brain. But how these changes arise is not so easy of explanation. Beer, therefore, only makes a brief enumeration of his own observations and pathologico-anatomical investigations into this part of the subject. The morbid changes in the structures above mentioned, which Beer has yet ascertained by dissection, consist in a real induration of the optic nerves, and an adhesion of them to their sheaths, while within the skull these ash-coloured gray very much diminished nerves presented no vestige of medullary structure even as far as their origin from the brain. On the contrary, the optic thalamus presented externally its natural appearance. The retina seemed to have lost its pulpy matter, was tough, not easily torn, and appeared to consist but of a vascular membrane. In one example, although both eyes had been completely deprived of sight together, Beer found only the retina and optic nerve of the left side in this state of atrophy as far forwards as the point of union in the sella turcica. On the other hand, the optic nerve of the right eye was hard, without being in the least dwindled, and was closely adherent to its external coverings. Anteriorly to their decussation, nothing at all preternatural in either nerve could be dis-

cerned. But the left corpus striatum was so indurated, that a very sharp strong scalpel was required for its division, though in colour and shape it was perfectly natural. On this side, also, the plexus choroides was entirely wanting. In three amaurotic patients of this kind, Beer found hydatids between the coverings of the optic nerve, and, where such hydatids lay, the medullary matter seemed to have been displaced by their pressure. With the utmost care, he could not trace the ophthalmic ganglion.

Paw also found in the optic nerve a large hydatid, which had produced amaurosis. (*Obs. Anat. Rarior. Obs. 2.*) In Mr. Heavyside's museum, there is a preparation of the optic nerve of an amaurotic eye, where a tumour of considerable bulk has grown from the neurilema. (See *Wardrop's Essays on the Morbid Anatomy of the Human Eye, Vol. 2. p. 157.*) In this work are specified examples of various other morbid changes of the optic nerve, especially calculous concretions within it, the presence of a viscid, muddy, gray fluid, in the thickened neurilema, instead of pulp, a dwindling of the nerve, &c.

To the present description of cases, Beer refers the instance recorded by Haller, (*Opusc. Pathol. Obs. 65, p. 172.*) in which a calcareous mass was found betwixt the membrane of Ruysch, and the vitreous humour. According to Beer, there is preserved in the pathological and anatomical museum of the general hospital at Vienna, an eye, distended with a similar osseous mass, without the capsule of the lens being at all affected. Examples, in which the amaurotic blindness arose from abscesses in the brain, are reported by Ballonius (*Paradigmata Hist. 7.*), by Pelargus, (*Med. Jahrg. 3, p. 198.*) Peyronie (*Mém. de l'Acad. Royale de Chir. 1, p. 212.*), Schaarschmid (*Berlin Nachrichten, 1740, No. 26.*), and Langenbeck. (*Neue Bibl. 1, p. 61.*) A case occasioned by disease of the thalamus is related by Villeneuve, (*Journ. de Med. continué 1811, Fevr. p. 98.*) another of a tumour of the thalamus on the same side as the blindness, is recorded by Ford, (*Med. Commun. Vol. 1, No. 4.*) and other swellings in various parts of the brain are described in *Ephem. Nat. Cur. Dec. 3, Ann. 9, and 10, Obs. 253*; *De Haen's Ratio Medendi, P. 6, p. 271*; *Journ. des Savans, 1697*; *Muzell's Wahrnehm. 2, No. 13*; *Plater, Obs. lib. 1, p. 108*; *Thomann, Annalen für 1800, p. 400, &c.* On this part of the subject, I beg leave to refer also particularly to my friend Mr. Wardrop's valuable *Essays on the Morbid Anatomy of the Human Eye, Vol. 2, p. 174, &c.*

The morbid alterations of the bones of the cavity of the skull mostly happen at its basis, and not only may caries take place, but still more frequently exostoses of various forms, which are sometimes so small that they are first detected by the bone giving the feel of a rough grater. At the same time they are so sharp, that if the finger be passed rudely over them, it will be

painfully hurt. In these cases, the bones of the cavity of the skull are always found extremely thin; the diploe is almost entirely wanting, and the parietes of the orbit are preternaturally diaphanous, and in some places imperfect. Beer speaks of a lady's skull, who had been completely blind, and for some weeks previously to her death insensible, in which instance scarcely any part of the cavity of the skull could be carelessly touched, without risk of scratching the fingers with spiculæ. Once, in an amaurotic boy, who, for a short time before his death, was so insane, that he used to devour his own excrement, Beer found at the side of the sella turcica a long considerable spicula, which passed directly through the optic nerves at the place of their decussation. A case of amaurosis produced by a spicula of bone, injuring the opposite side of the brain, is related by Anderson. (See *Trans. of the Society of Edinb. Vol. 2.*) Sometimes the ethmoid bone has been found carious, (*Ballonius, Paradigmata, No. 7.*) sometimes other parts of the cranium. (*Mursinna, Beobacht 1, No 6; Schmucker, Vermischte Schrift. 2, p. 12.*) Nor is it unfrequent to find the medullary substance of the brain itself as soft as pap, while the cortical substance is full of blood-vessels and unusually firm, the convolutions being hardly distinguishable. It further seems as if only particular individuals were liable to these two forms of amaurosis; for hitherto Beer has not met with these morbid changes of the optic nerves and their coverings, except in emaciated, badly nourished amaurotic patients, in whom some clear signs of scrophula had appeared during youth, especially in the glands of the neck; while the above described changes in the bones of the skull and in the brain itself, Beer has seen only in such amaurotic patients as evidently had suffered in their youth from rachitis throughout their whole osseous system, and who at a later period had had syphilis, or, in their best days, been decidedly gouty. In almost all these cases, a careful inquiry into their history tended to prove, that the affection of the head and eyes had been preceded by a sudden exposure of the head to cold, whence arose rheumatism, particularly affecting the aponeurosis under the scalp, though at first it was apparently inconsiderable.

What degree of accuracy may belong to the foregoing observations, I cannot pretend to say, though it is impossible for me not to suspect, that they are less valuable and correct, than some other remarks made by this experienced writer.

Many of the causes of amaurosis are of such a nature, as to render the disease totally incurable. Of this description is fungus hæmatodes, in which the structure of the retina and optic nerve is changed in a remarkable manner, the whole cavity of the eyeball becoming filled with a substance resembling medullary matter, and the optic nerve changed in its form, colour, and structure. (See *Wardrop's Essays on the*

Morbid Anatomy of the Human Eye, Vol. 2, p. 156, 8vo. Lond. 1818.)

On the authority of Ecker, one case is upon record, where the cause of amaurosis depended upon an aneurism of the central artery of the retina. (*Pinel, Nosographie Philos. Vol. 2, p. 122.*)

In another instance, the macula lutea, which is naturally a yellow spot near the centre of the retina, was found black. (*Mém. de la Société Méd. d'Emulation, an. 1798.*)

Bonetus, in his *Sepulchretum Anatomicum, lib. 1, sect. 18*, describes various cases which were quite incurable. After death, the blindness, in one instance, was found to be occasioned by an encysted tumour, weighing fourteen drams, situated in the substance of the cerebrum, and pressing on the optic nerves near their origin. In a second, the blindness was produced by a cyst, containing water, and lodged on the optic nerves where they unite. In a third, it arose from a caries of the os frontis, and a consequent alteration in the figure of the optic foramina. In a fourth, the cause of the disease was a malformation of the optic nerves themselves. In some of the instances, in which no apparent alteration can be discovered in the optic nerve, Mr. Ware conjectures whether a dilatation of the anterior portion of the circulus arteriosus may not be the cause of the affection. The circulus arteriosus is an arterial circle, surrounding the sella turcica, formed by the carotid arteries on each side, branches passing from them to meet each other before, and other branches passing backwards, to meet branches from the basiliary artery behind. The anterior part of the circulus arteriosus lies directly over, crosses, and is in contact, with the optic nerves, and just in the same way as the anterior branches lie over the optic nerves, the posterior ones lie over the nervi motores oculorum. Hence Mr. Ware attempts to refer the amaurosis itself, and the paralytic affection of the eyelids, and muscles of the eye, sometimes attendant on the complaint, to a dilatation of the anterior and posterior branches of the circulus arteriosus. Dr. Baillie has noticed, in his *Morbid Anatomy*, the frequently diseased state of the trunk, or the small branches of the carotid arteries at the side of the sella turcica; and he says the same sort of diseased structure is also found in the basiliary artery and its branches. (See *Ware's Chir. Obs. on the Eye.*)

When the diagnosis of these cases is perfectly clear, the prognosis can admit of no doubt; for, in the present state of medical science, what intelligent surgeon can here forbode any thing else, than the gradual formation of complete blindness (if that be not already produced,) and not merely death, but one of a miserable description. Nay, says Beer, even where some specific constitutional disease is manifestly concerned in the production of the amaurosis, like syphilis or gout, none but a fool would hold out any hope of benefit to the patient, be-

cause, in general, when the practitioner is sent for, not only the constitutional complaints have become too deeply rooted and inveterate, but the system has been already too much reduced by anxiety, long suffering, and manifold courses of medicine, for any prospect of a cure of the general disorder to be entertained, much less that of the existing blindness. It is only when this dreadful disease of the head and eyes assuredly proceeds from some known specific disorder that any mode of treatment can be adopted, which is founded on principle. As far as Beer's experience goes. however, the treatment always fails; an event, which, in supposed syphilitic and gouty cases, where the strongest mercurials, antimonials, and other alteratives are useless, he ascribes to the debilitated state of the constitution; but which he might, with more propriety, impute both to our total ignorance of any connexion between the blindness and syphilis, or gout, and to our having no medicine which has the slightest power to check or remove the morbid changes in the optic nerve and its coverings, or in the cranium or brain. Neither, says Beer, can any good be done by scorbutic medicines, where the amaurotic patient has betrayed symptoms of scurvy. The treatment then must be more or less empirical, which is always the most subject to failure, and the least deserving of confidence, especially in these desperate urgent cases. As for local treatment of the eye itself, it is obvious, that nothing need here be said upon the subject. (See *Beer's Lehre von den Augenkr.* B. 2, p. 576. 584.)

L. Heister, *Apologia et uberior Illustratio Systematis sui de Cataracta, Glaucomate, et Amaurosi*, 12mo. Altorf, 1717. J. B. G. Ehme, de *Amaurosi*, 4to. Lips. 1748, in *Halleri Disp. Chir.* 2, 265. Jos. Warner, *Description of Human Eye, and diseases*, 8vo. Lond. 1754. A. Ross, de *Amaurosi*, Edinb. 1754. Diderot, *An Essay on Blindness*, transl. from the French, 12mo. Lond. 1773. Chabibert, *A Dissertation upon the Gutta Serena*, &c. 8vo. Lond. 1774. Truka de Krzowitz, *Historia Amauroseos*, 8vo. Vindob. 1781. Gius. Flajani *Collezione d'Osservaz.* &c. T. 4, p. 173. 187, 8vo. Roma, 1803. D. G. Kieser, *Ueber die Natur Ursachen, Kennzeichen und Heilung des schwarze Staars*, 8vo. Gott. 1811. Langenbeck, *Neue Bibl. für die Chirurgie*, B. 1; Hanover, 1815. J. Beer, *Lehre von den Augenkrankheiten*, B. 2, 8vo. Wien, 1817. James Wardrop, *Essays on the Morbid Anatomy of the Human Eye*, Vol. 2, 8vo. Lond. 1818. The two latter books are works of the highest merit; and, as we have no translation of the first, I have thrown a good deal of the information which it contains on amaurosis into the present edition. B. A. Winkler, *De Amaurosi*, 12mo. Berol. 1818. *Vermischte Chirurgische Schriften von J. L. Schmucker*, B. 2, Berlin. Ed. 2. 1786. *Remarks on Ophthalmy*, &c. by James Ware. Inquiry into the causes preventing success in the extraction of the Cataract, &c. by the same. *Osservazione sulle Malattie degli Occhi di A.*

Scarpa, Venez. 1802. This book has gone through five editions in Italy. The last, which is much improved, has been well translated by Mr. Briggs. W. Hey in *Practical Observations in Surgery, and Med. Obs. and Inquiries*, Vol. 5. *Schmucker's Wahrnehmungen*, B. 1, p. 273. Richter's *Anfangsgründe der Wundarzneykunst*, B. 3. Chandler's *Treatise on the Diseases of the Eye*, chap. 24. 8vo. Lond. 1780. Some scattered remarks in the posthumous work on the diseases of the eye, of the late J. C. Saunders, &c. De Wenzel, *Manuel de l'Oculiste, ou Dictionnaire Ophthalmologique*, 8vo. Paris, 1808.

Many additional observations connected with the subject of Amaurosis will be found in the articles *Cataract*, *Diplopia*, *Gutta Serena*, *Hemeralopia*, *Hemiopia*, *Nyctalopia*, *Sight Defects of*, &c.

AMBE. (from *αμβη*, the projecting edge of a rock.) An old chirurgical machine for reducing dislocations of the shoulder, and so called, because its extremity projects, like the prominence of a rock. Its invention is imputed to Hippocrates. The ambe is the most ancient mechanical contrivance for the above purpose; but, it is not at present employed. Indeed, it is scarcely to be met with in the richest cabinets of surgical apparatus. It is composed of a piece of wood, rising vertically from a pedestal. With the vertical piece is articulated, after the manner of a hinge, an horizontal piece, with a gutter formed in it, in which the luxated limb is laid, and secured with straps. The patient places himself on one side of the machine; his arm is extended in the gutter, and secured; the angle, formed by the union of the ascending piece, and by the horizontal branch, is lodged in the armpit, and then the horizontal branch is depressed. In this way extension is made, whilst the vertical part makes counter extension, and its superior part tends to force the head of the humerus into the articular cavity. But, there is nothing to fix the scapula, and the compression made by the superior portion of the vertical piece of the machine tends to force the head of the humerus into the glenoid cavity, before it is well disengaged by the extension. (*Boyer on Diseases of the Bones*, Vol. II.)

AMBLYOPIA. (from *αμβλως*, dull, and *ωφ*, the eye.) Hippocrates means by this word, in his Aph. 31. Sect. 3. the dimness of sight, to which old people are subject. Modern writers generally understand by amblyopia, incomplete amaurosis, or the weakness of sight attending certain stages and forms of this disorder. (See *L'Encyclopedie Methodique; Partie Chirurgicale; Art. Amblyopie*.)

AMMONIÆ MURIAS, AMMONIA, MURIATA, or *Sal Ammoniac*. Its chief use in surgery is as an external discutient application. (See *Lotio Ammon. Muriatæ cum Aceto*.)

Mr. Justamond recommends the following application to milk-abscesses: R *Ammonię Muriatæ* ℥j. *Spiritus Roris marini* ℔j. *Misce*. Linen rags are to be wet with the

remedy, and kept continually applied to the part affected.

There can be little doubt of the utility of this lotion in dispersing the induration, left after mammary abscesses; but, while these cases are accompanied with much pain, tension, and inflammation, emollient fomentations and poultices are to be preferred.

* **AMPUTATION.** (from *amputatio*.) This term signifies the operation of cutting off a limb, or other part of the body, as the breast, penis, &c.

Such an operation frequently becomes indispensably proper, on the principle of sacrificing a branch, as it were, for the sake of taking the only rational chance of saving the trunk itself. Indeed, the suggestion of this measure, in cases of mortification, where there is no chance of the parts recovering, may be said to be derived from nature herself, who by a process, to which I shall advert in speaking of *mortification*, detaches the dead from the living parts; this separation is followed by cicatrization, and the patient recovers.

The necessity for amputation has always existed, and ever will continue, as long as the destructive effects of injuries and diseases of the limbs cannot be obviated in any other manner. As Graefe observes, there was once a period, (I should say, about forty years ago) when the operation was more frequently practised, than at present, and this fact is to be imputed less to the caprice of surgeons, than to the imperfection of the means which used to be employed for the relief of local diseases. For then aneurisms of the limbs, and some other cases, at present treated with success, were always deemed incurable without amputation. Boucher, Gervaise, Faure, and Bilguer inveighed against the frequent performance of amputation on the field of battle; yet their arguments must prove of little value, unless a path were at the same time traced, which would conduct us to the method of remedying the circumstances which form the necessity for the operation. When this condition is fulfilled, and more effectual modes of treatment are devised, as for instance, with respect to the gunshot wounds, specified by Bilguer, then the necessity for amputation in such cases would cease of itself. (*Normen für die Ablösung grösserer Gliedmassen*, p. 13, 4to. Berlin, 1812.)

As the author of another valuable modern work has said, it is an excellent observation, founded on the purest humanity, and justified by the soundest professional principles, that to *save one limb is infinitely more honourable to the surgeon, than to have performed numerous amputations, however successful*; but it is a remark, notwithstanding its quaintness, fully as true, that it is much better for a man to "live with three limbs, than to die with four." (*Hennen on Military Surgery*, p. 251, Ed. 2.)

To this saying should be added the reflection, that some unfortunate beings, influ-

enced by a relish for life, have been known to submit to the loss of all their legs and arms, and yet recover. In the *Hôtel des Invalides* at Paris, mutilated objects are in recollection, who had lost their thighs and arms, so that, unless assisted, they could not stir, and it was necessary to feed and wait upon them, like new-born infants. (*Morand Opusc. de Chir*, p. 183, and *Graefe Op. cit.* p. 23.)

The amputation of the large limbs was anciently practised under many disadvantages. The best way of making the incisions was unknown; the ignorance of the old surgeons of the right method of stopping hemorrhage was the death of a large proportion of the patients, who had courage to submit to the operation; the mode of healing the wound by the first intention was not understood, or not duly appreciated; and the instruments were as awkward and clumsy, as the dressings were irritating and improper.

Modern practitioners have materially simplified all the chief operations in surgery; an object, which has been accomplished not merely by letting anatomical science be the main guide of their proceedings; not simply by devising more judicious, and less painful methods; not only by diminishing the number, and improving the construction of instruments; but also in a very essential degree by abandoning the use of a multitude of external applications, most of which were useless or hurtful.

The Greek, Roman, and Arabian practitioners amputated limbs with feelings of alarm, and, in general, with the most melancholy results; while modern surgeons proceed to the operation completely fearless, well knowing that it mostly proves successful: hence, as Graefe justly remarks, nothing can be more evident, than that the patient's safety must depend very much upon the kind of practice. (See *Normen für die Ablösung grösserer Gliedmassen*, p. 1.) By practice, is here implied the mode in which the operation is performed, the way in which the wound is dressed, and the whole of the after-treatment.

But, much improved as amputation has been, it cannot be dissembled, that it is an operation at once terrible to hear, dreadful to behold, and sometimes severe and fatal in the consequences which it itself produces, while the patient, if saved, is left for ever afterwards in a crippled mutilated state. Hence, it is the surgeon's duty never to have recourse to so serious a proceeding, without a perfect and well-grounded conviction of its necessity. Amputation should be generally regarded as the last expedient to which a surgeon ought to resort; an expedient justifiable, as a late writer says, only when the part is either already gangrenous, or the seat of so much injury, or disease, that the attempt to preserve it any longer, would expose the patient's life to the greatest danger. (*Dict. des Sciences Med.* T. 1, p. 472.)

Although, says a distinguished modern

surgeon, this amounts to a confession, that the cure of some local disorders is not within the limits of our art, yet, on the other hand, it furnishes a proof, that surgery may be the means of saving life under circumstances, which, without its assistance, would infallibly have a fatal termination. The operation is adopted as the safest measure; the cause is removed for the prevention of consequences. (*Græfe, Op. cit. p. 14.*)

Nothing can be more absurd, or more misapplied, than the censures sometimes passed upon amputation, because the body is mutilated by it, &c. Although, as a modern writer remarks, the objection proves the limitation of human knowledge and ability, it must be very unfair on this account to throw blame on surgery, or the practitioner who thus saves the patient's life. For, without dwelling upon the fact, that a humane surgeon would never amputate through a mere love of operating, and without urgent cause, one may simply ask, are all diseases in their nature curable? Does not the surgeon cure such as are curable, without mutilation? And are not cases, which were in the beginning remediable, often first brought to the surgeon, when from neglect they have become totally incurable? Is it not his duty then to employ the only means left for saving the patient? And is not the preservation of a long and healthy life a compensation for the sacrifice? Would it not be just as reasonable to blame an architect, when the irresistible force of lightning or a bomb destroys his building? Indeed, is it not rather a greater honour to surgery, that, even when death has already taken possession, as it were, of a part, and is threatening inevitable destruction to the whole, a means is yet furnished, not only for saving the patient's life, but for bringing him into a state, in which he may recover his former good health? (*Brünninghausen, Erfahrungen und Bemerkungen über Die Amputation, p. 11, 12mo. Bamberg, 1818.*)

Though amputation is in every respect much better, than in former times, and its right performance is by no means difficult; I would not wish to be thought to say, that it is always or even usually done *secundum artem*, because long opportunities of observation have convinced me of the contrary; and the reason of the knife being yet so badly handled in this part of surgery, may generally be imputed to carelessness, slovenly habits, or, what is as bad, a want of ordinary dexterity. There are several egregious faults in the method of amputating, which even many hospital surgeons in this metropolis are guilty of; but these we shall find, when we criticise them, are, for the most part, easily avoidable, without any particular share of skill being required. A greater difficulty is to ascertain with precision the cases, which demand the operation; those in which it may be dispensed with; and the exact periods at which it should be practised. These are considerations requiring profound attention, and the brightest talents. The most expert opera-

tor (as Mr. O'Halloran observes) may not always be the best surgeon. To do justice to the sick and ourselves, we must, in many cases, rather avoid than perform capital operations; and with respect to amputation, if we consider the many cases, in which it has been unnecessarily undertaken, or done at unseasonable periods, it may be suspected, that this operation, upon the whole, may have done more mischief than good. At all events, it is not enough for a surgeon to know *how* to operate; he must also know *when* to do it. (See *O'Halloran on Gangrene and Spæcelus; preface.*)

For such reasons, I shall first take a view of the circumstances, under which, the best surgeons deem amputation necessary: though it may be proper to observe, that, in each of the articles, relative to the particular diseases and injuries, which ever call for the operation, additional information will be offered.

1. Compound fractures.

In a compound fracture, the necessity for amputation is not altogether proportioned to the seriousness of the accident, but also frequently depends in part upon other circumstances. For example, in the field and on board of a crowded ship, it is not constantly in the surgeon's power to pay such attention as the cases demand, nor to procure for the patient the proper degree of rest and good accommodation. In the field, there is often a necessity for transporting the wounded from one place to another. Under these circumstances, it is proper to have immediate recourse to amputation, in numerous cases of bad compound fractures, some of which, perhaps, might not absolutely demand the operation, were the patients so situated, as to be capable of receiving all the advantages of the best and most scientific treatment in a well-ventilated quiet house, or hospital, furnished with every desirable convenience. At the same time, daily experience proves, that there are many other cases, in which it would be improper to have recourse to the knife, even under the most unfavourable circumstances of the above description. So, when a compound fracture occurs, in which the soft parts have not been considerably injured; in which the bones have been broken in such a direction that they can be easily set and kept in their proper position, or in which there is only one bone broken, amputation would be unnecessary and cruel. But, when the soft parts have been more extensively hurt, and the bones have been so badly broken, that perfect quietude and incessant care are required to afford any chance of recovery, it is a good general rule to amputate whenever these advantages cannot be obtained.

The bad air in crowded hospitals and large cities, a circumstance so detrimental to wounds in general, is another consideration which may seriously lessen the chances of saving a badly broken limb, and should be remembered in weighing the reasons for and against amputation.

On this part of the subject, I find the sentiments of Graefe interesting: besides an absolute, says he, there is a relative, necessity for amputation: it is [the most mournful, and proceeds altogether from unfavourable external circumstances, though, alas! in many cases nearly unavoidable, when life is to be preserved. In war, every bloody action furnishes proof of what has been stated. The number of the wounded is immense; the number of surgeons for the duty too limited. The supplies most needed are at a distance. In these emergencies, though the military surgeon may from routine and genius be able to suggest the quickest method of obtaining what is wanted, know how to avail himself of every advantage, which circumstances permit, and to contrive tolerable substitutes for such things as are deficient, yet, this will not always do. Were we (says Graefe) here to complain of the Prussian government not providing due assistance for the defenders of our native soil, to many the remonstrance would only appear reasonable. Yet, they who manage the medical affairs of the Prussian army may not constantly have it in their power to avert the inconvenience. The general cannot foretell the number and nature of the wounds, which may happen, so as to enable the medical department to take with them exactly the apparatus required, without encumbering the army with a redundancy of useless articles. The enemy, perhaps, captures the medical stores; or the rapid movements of particular corps cut us off from the principal depôts. Detachments often skirmish at remote points. The hospitals may lie several miles in the rear of the line; and, for want of means, the transport of the imperfectly dressed wounded may continue night and day. Hardly are the sufferers brought into the nearest hospital, in the most pitiful state from pain, anxiety, and cold, when an order is given to break up, and they must be conveyed still further towards their grave; and a thousand other circumstances, as Graefe observes, which deprive the wounded of the requisite attendance, and essential number of surgeons, together with the most necessary stores, make it desirable to simplify every wound as much as possible; which, indeed, is the only means of shunning the reproach, that while we are endeavouring to save one man's limb, we let another die.

Who doubts, says Graefe, that a soldier with a gunshot wound, complicated with a smashed state of the bones, may sometimes be saved, without loss of his limb, by employing all the means; which the resources of surgery offer? But these very resources are often wanting in a campaign; and the business of dressing the patient would occupy the surgeon several hours daily, during which his useful assistance could not be extended to other sufferers. Notwithstanding the utmost care, the removal of patients from one place to another frequently makes their wounds extremely danger-

ous, or fatal; and we now lose many a man, who, had he undergone amputation, would have been able to bear the journey. (See *Normen für die Ablösung grösserer Gliedmassen*, p. 15, 16.)

From what I have seen of the ill effects of moving patients with bad compound fractures of the lower extremity, produced by gunshot violence, I am convinced, that, as a general rule, it is better to perform amputation; but, if this be not done, and an attempt is to be made to save the member, it will be more humane, when the army is retreating, and the enemy are not savages, to leave such wounded behind, than subject them to all the fatal mischief of hastily and roughly transporting them in such a condition. It gives me particular pleasure to find the preceding sentiment confirmed by Dr. Hennen, whose knowledge and experience in military surgery entitle all his opinions to the greatest attention: in noticing what ought to be done with the wounded, when the army is compelled to retreat, he says, "it then becomes the duty of a certain proportion of the hospital staff to devote themselves for their wounded, and become prisoners of war along with them; and it may be an encouragement to the inexperienced, while it is grateful to me, to observe, that I have never witnessed, nor traced, on inquiry, an act of unnecessary severity practised either by the French or English armies on their wounded prisoners."

Compound fractures of the thigh, produced by gunshot violence, too often have an unfavourable termination, especially when the accident has been caused by grape-shot, or even a musket-ball, fired from a moderate distance, and the patient is moved from one place to another after the receipt of the injury. In the military hospital at Oudenbosch, in the spring of 1814, I had charge of about eight bad compound fractures of the thigh, of which cases only one escaped a fatal termination. This was an instance, in which the femur was broken a little way above the knee. Another patient was extricated by amputation from the perils, immediately arising from the splintered displaced state of the bone, the serious injury of the muscles, and enormous abscesses, but was unfortunately lost by secondary hemorrhage. All these patients had not merely been struck by grape-shot, or else by balls fired from a short distance, but they had been moved from Bergen-op-Zoom into my hospital, five or six days after the receipt of the injury, the very worst period possible, on account of the inflammation being then most violent. From the ill success of these cases, many a surgeon, who saw them, might be inclined to think, that immediate amputation ought generally to be performed for all compound fractures of the thigh, as soon after the receipt of the injury as possible. And such is my own sentiment, whenever the accident has been caused in the violent man-

near above specified, or whenever the patient must be moved any distance in a wagon after the occurrence of the injury. It may be right to state, however, that I have known more than one compound fracture of the thigh cured, where the accident had not been occasioned by gunshot violence, and I have been informed of one or two successful cases, where the bone was broken by a pistol-ball. However, these may only have been lucky escapes, deviations from what is common, and not entitled to any stress with the view of affecting the general excellent rule of amputating, where the thigh-bone is broken by gunshot violence.

As Mr. Guthrie has accurately observed, one circumstance, which increases the danger of fractures of the femur, from gunshot violence, is, that the bone is very often broken obliquely, the fracture extending far above and below the point immediately struck by the ball. (*On Gunshot Wounds*, p. 189, 190.) This disposition of the thigh-bone to be splintered for several inches when hit by a ball, and the increased danger, arising from the occurrence, are also very particularly commented upon by the experienced Schmucker, who was surgeon-general to the Prussian armies in the campaigns of Frederick the Great. (See his *Vermischte Chirurgische Schriften*, B. 1. p. 39. 8vo. Berlin, 1785.) In several of the cases which were under the care of Dr. Cole and myself in Holland, the bone was split longitudinally, to the extent of seven or eight inches.

According to Schmucker, all fractures of the middle or upper part of the femur, are attended with great danger. "But (says he) if the fracture be situated at the lowest part of the bone, the risk is considerably less, the muscles here not being so powerful; in such a case, therefore, amputation should not be performed, before every other means has been fairly tried; and very frequently I have treated fractures of this kind with success, though the limb sometimes continued stiff. But (says Schmucker) if the bone be completely fractured or splintered by a ball at its middle, or above that point, I never wait for the bad symptoms to commence, but amputate ere they originate, and, when the operation has been done early enough, most of my patients have been saved. However, when some days had transpired, and inflammation swelling, and fever had come on, I must candidly confess, that the issue was not always fortunate. Yet the operation should not, on this account, be dispensed with; for, if only a few can thus be saved out of many, some benefit is obtained, as, without this step, such few would also perish." (*Vermischte Chir. Schriften*, B. 1. p. 42.) What I saw of compound fractures of the thigh, after the assault on Bergen-op-Zoom, we may remark, coincides with the results of Schmucker's ample experience; for the only two patients who got over the bad symptoms proceeding directly from the

fracture, were one whose femur was broken near the knee; and another, whose limb I took off, on account of a fracture of the middle of the bone, accompanied with abscesses of surprising extent. The latter was a case, however, in which the limb ought to have been removed earlier. The following remarks by Mr. Guthrie, I consider judicious and correct.

"The danger and difficulty of cure, attendant on fractures of the femur from gunshot wounds, depend much on the part of the bone injured; and, in the consideration of these circumstances, it will be useful to divide it into five parts. Of these, the head and neck included in the capsular ligament, may be considered the first; the body of the bone, which may be divided into three parts, and the spongy portion of the lower end of the bone exterior to the capsular ligament, forming the fifth part. Of these, the fractures of the first kind are, I believe, always ultimately fatal, although life may be prolonged for some time. The upper third of the body of the bone, if badly fractured, generally causes death at the end of six or eight weeks of acute suffering. I have seen few escape, and then not with a useful limb, that had been badly fractured in the middle part. Fractures of the lower or fifth division, are in the next degree dangerous, as they generally affect the joint; and the least dangerous are fractures of the lower third of the body of the bone. Of these even I do not mean to conceal, that when there is much shattered bone, the danger is great, so that a fractured thigh by gunshot, even without particular injury of the soft parts, is one of the most dangerous kinds of wounds that can occur." (See *Guthrie on Gunshot Wounds*, p. 190.)

In compound fractures, as Mr. Pott has correctly pointed out, there are three points of time when amputation may be proper. The first of these is immediately, or as soon as possible after the receipt of the injury. The second is, when the bones continue for a great length of time without any disposition to unite, and the discharge from the wound has been so long, and is so large, that the patient's strength fails, and general symptoms foreboding dissolution come on. The third is, when a mortification has taken such complete possession of the soft parts of the inferior portion of the limb, quite down to the bone, that upon the separation of such parts, the bone or bones shall be left bare in the interspace.

The first and second of these are matters of very serious consideration. The third hardly requires any.

When a compound fracture is caused by the passage of a very heavy body over a limb; such, for instance, as the broad wheel of a wagon or loaded cart, or by the fall of a very ponderous body on it, or by a cannon shot, or by any other means so violent as to break the bones into many fragments, and so to tear, bruise, and wound the soft parts, that there shall be good reason to fear, that there will not be vessels sufficient

to carry on the circulation with the parts below the fracture, it becomes, as Mr. Pott observes, a matter of the most serious consideration, whether an attempt to save such a limb will not occasion loss of life. This consideration must be before any degree of inflammation has seized the part, and therefore must be immediately after the accident. When inflammation, tension, and a disposition to gangrene in the limb have arisen, the period is highly disadvantageous for operating, and the patient's chances of being saved by amputation, under these circumstances, are much smaller than before the changes here spoken of had taken place. At the same time, there are certain examples of mortification from external causes, where, as far as one can judge from the results of later experience than that of Mr. Pott, the surgeon should not defer amputation, even though the disorder be yet in a spreading state, attended with considerable swelling and tension reaching far up the limb. This is a subject, however, which will require more explanation hereafter. (See what is presently said on *Mortification*.) Nor are the cases, to which reference is made, meant to affect the general truth of the observation, delivered by the most experienced surgeons of every age, that when a limb is extensively swelled and inflamed, with a part of it either in a state of spreading mortification, or ready to become gangrenous, the period is so unfavourable for amputation, that very few patients, so circumstanced, ever recover after the operation. Nor is it meant to be insinuated, that in the very cases which form exceptions to the general rule of not amputating before the tendency to gangrene has ceased, the patient might not have had an infinitely better chance of his life, had the operation been done immediately after the first receipt of the injury, before any disposition to gangrene had had time to be produced.

The necessity of immediate or very early decision, in this case, makes this a very delicate part of practice; for, however pressing the case may seem to the surgeon, it will not, in general, appear in the same light to the patient; to the relations, or to bystanders. They will be inclined to regard the proposition as arising from ignorance, or an inclination to save trouble, or a desire to operate; and it will often require more firmness on the part of the practitioner, and more resignation and confidence on the part of the patient, than is generally met with, to submit to such a severe operation, in such a seeming hurry, and upon so little apparent deliberation; and yet it often happens, that the suffering this point of time to pass, decides the patient's fate.

This necessity of early decision arises from the quick tendency to mortification, which ensues in the injured limb, and too often ends in the patient's death. That this is no exaggeration, says Pott, melancholy and frequent experience evinces, even in those whose constitutions, previous to the

accident, were in good order; but much more in those, who have been heated by violent exercise or labour, or liquor, or who have lead very debauched and intemperate lives, or who have habits naturally inflammable and irritable. This is often the case when the fracture happens to the middle part of the bones, but is much more likely to happen when any of the large joints are concerned. In many of these cases, a determination for or against amputation, is really a determination for or against the patient's existence.

That it would have been impossible to have saved some limbs, which have been cut off, no man will pretend to say; but this does not render the practice injudicious. Do not the majority of those who get into the above hazardous condition, and on whom amputation is not performed, perish in consequence of their wounds? Have not many lives been preserved by amputation, which, from the same circumstances, would otherwise most probably have been lost?

Pressing and urgent as the state of a compound fracture may be, at this first point of time, still it will be a matter of choice, whether the limb shall be removed or not; but, at the second period, the operation must be submitted to, or the patient must die.

The most unpromising appearances at first, do not necessarily, or constantly end unfortunately. Sometimes, after the most threatening first symptoms, after considerable length of time, great discharges of matter, and large exfoliations of bone, success shall ultimately be obtained, and the patient shall recover his health and the use of his limb.

But sometimes, after the most judicious treatment through every stage of the disease; after the united efforts of physic and surgery, the sore, instead of granulating kindly, and contracting daily to a smaller size, shall remain as large as at first, with a tawny, spongy surface, discharging a large quantity of thin sanies, instead of a small one of good matter; the fractured ends of the bones, instead of tending to exfoliate, or to unite, will remain as perfectly loose and disunited as at first, while the patient shall lose his sleep, his appetite, and his strength; a hectic fever, with a quick, small, hard pulse, profuse sweats, and colliquative purging, contributing at the same time to bring him to the brink of the grave, notwithstanding every kind of assistance: in these circumstances, if amputation be not performed, Mr. Pott asks, what else can rescue the patient from destruction?

The third and last period is a matter which does not require much consideration. Too often the inflammation consequent upon the injury, instead of producing abscess and suppuration, tends to gangrene and mortification, the progress of which is often so rapid, as to destroy the patient in a very short space of time, constituting that very sort of case in which amputation should

have been immediately performed. But sometimes even this dreadful malady is, by the help of art, put a stop to, but not until it has totally destroyed all the surrounding muscles, tendons, and membranes quite down to the bone, which, upon the separation of the mortified parts, is left quite bare, and all circulation between the parts above and those below, is by this totally cut off. In this instance, whether the surgeon saw through the bare bone, or leave the separation to be effected by nature, the patient must lose his limb. (See *Pott's Remarks on the Necessity, &c. of Amputation in certain Cases, &c. Chir. Works, vol. 3.*)

For the consideration of a variety of complicated cases, which affect the question of amputation in compound fractures, I must refer to the article *Gunshot Wounds*.

2. Extensive contused and lacerated wounds.

These form the second class of general cases requiring amputation. Wounds without fracture are not often so bad as to require this operation. When a limb, however, is extensively contused and lacerated, and its principal blood-vessels are injured, so that there is no hope of a continuance of the circulation, the immediate removal of the member should be recommended, whether the bones be injured or not. Also, since no effort on the part of the surgeon can preserve a limb so injured, and such wounds are more likely to mortify than any others, the sooner the operation is undertaken the better.

In these cases, as in those of compound fractures, though amputation may not always be necessary at first, it may become so afterwards. The foregoing observations, relative to the second period of compound fractures, are equally applicable to badly lacerated wounds, unattended with injury of the bones. Sometimes a rapid mortification comes on; or a profuse suppuration, which the system can no longer endure. (*Encyclopédie Méthodique; Partie Chir. t. 1. p. 80.*)

3. Cases in which part of a limb has been carried away by a cannon ball.

When part of a limb has been torn off by a cannon ball, or any other cause, capable of producing a similar effect, the formation of a good and serviceable stump, the greater facility of healing the clean, regular wound of amputation, and the benefit of a far more expeditious as well as of a sounder cure, are the principal reasons which here make the operation advisable.

This was an instance, in which some former surgeons disputed the necessity of amputation. They urged as a reason for their opinion, that the limb being already removed, it is better to endeavour to cure the wound as speedily as possible, than increase the patient's sufferings and danger, by making him submit to amputation. It must be remembered, however, that the bones are generally shattered, and reduced into

numerous fragments; the muscles and tendons are unequally divided, and their ends torn and confused. Now, none of the old surgeons questioned the absolute necessity of extracting the splinters of bone, and cutting away the irregular extremities of the tendons and muscles, which operations would require a longer time than amputation itself. Besides, we should recollect, that, by making the incision above the injured part, so as to be enabled to cover the bone with flesh and integuments, perfectly free from injury, the extent of the wound is so diminished, that the healing can be accomplished in one third of the time which would otherwise be requisite, and a much firmer cicatrix is also obtained. Such reflections must convince us, that amputation here holds forth very great advantages. It cannot increase the patient's danger, and, as for the momentary augmentation of pain, which he suffers, he is amply compensated by all the benefits resulting from the operation. See *Gunshot Wounds*.

4. Mortification.

Mortification is another cause, which, when advanced to a certain degree, renders amputation indispensably proper. We have noticed, that bad compound fractures, and wounds, often terminate in the death of the injured limb. Such surgeons as have been determined, at all events, to oppose the performance of amputation, have pretended, that the operation is here totally useless. They assert, that when the mortification is only in a slight degree, it may be cured, and that when it has spread to a considerable extent, the patient will perish, whether amputation be performed or not. But this way of viewing things is so contrary to facts, and the experience of every impartial practitioner, that I shall make no attempt to refute the assertion. While it is allowed that it would be very bad practice, to amputate on every slight appearance of gangrene, it is equally a fact, that when the disorder affects the substance of a member, the operation is generally the safest and most advantageous measure. Nay, there are, as we shall presently see, certain forms of mortification, in which the early performance of amputation is the only chance of saving the patient.

Practitioners have entertained very opposite opinions, concerning the period when one should operate in cases of mortification. Some pretend, that whenever the disorder presents itself, and especially when it is the effect of external violence, we should amputate immediately the mortification has decidedly begun to form, and while the mischief is in a spreading state. Others believe, that the operation should never be undertaken, before the progress of the disorder has stopped, even not till the dead parts have begun to separate from the living ones.

The advocates for the speedy performance of amputation declare, that the further progress of the mortification may be stop-

ped, and the life of the patient preserved, by cutting above the parts affected. However, according to the reports of the greater number of eminent surgical writers, this practice is highly dangerous, and undeserving of confidence. Whatever pains may be taken in the operation, only to divide sound parts, there is no certainty of succeeding in this object, and the most skilful practitioner may be deceived. The skin may appear to be perfectly sound and free from inflammation, while the muscles which it covers, and the parts immediately surrounding the bone, may actually be in a gangrenous state. But even when the soft parts are found free from apparent distemper, on making the incision, still, if the operator should not have waited till the mortification has ceased to spread, the stump will almost always be attacked by gangrene. Surgeons, who have had opportunities of frequently seeing wounds which have a tendency to mortify, entertain the latter opinion. Such was the sentiment of Pott, who says, that he has often seen the experiment made, of amputating a limb in which gangrene had begun to show itself, but never saw it succeed, and it invariably hastened the patient's death.

The operation may be postponed, however, too long. Mr. S. Sharp, in particular, recommended too much delay, advising the operation never to be done till the natural separation of the mortified parts had considerably advanced. Mr. Sharp was a surgeon of immense experience; and his authority carries with it the greatest weight. But perhaps he was too zealous in his opposition to a practice, the peril of which he had so often beheld. When the mortification has ceased spreading, there is no occasion for further delay. We now obtain, just as certainly, all the benefits of the operation, and get rid of a mass of putridity, the exhalations from which poison the atmosphere which the patient breathes, and are highly detrimental to his health. Nay, according to the reports of writers, patients in these circumstances may actually fall victims to the absorption of the putrid matter which is suffered to remain too long. However, this danger would not be so considerable as that which would arise from too precipitate an operation; and it is better to defer amputation a little more than is absolutely requisite, than run any risk of doing the operation before it is certain that the parts have lost their tendency to gangrene.

In the article *Mortification*, we have noticed particular cases of gangrene, where, according to the experience of M. Larrey, the surgeon is not to wait for the line of separation being formed, but have recourse to the immediate performance of amputation. The experience of Mr. Lawrence tends also to confirm the propriety of such practice. (See *Medico-Chir. Trans.* vol. 6, p. 156, &c.)

In an example, where a large part of the arm was deeply affected with gangrene

from external violence, and the disorder was yet making rapid progress, I once recommended the performance of amputation at the shoulder joint. On the whole, this instance was favourable to the practice; for, though the patient died at the end of a fortnight, probably he would not have lived twenty-four hours, had the operation not been done; nor was the stump attacked with mortification, a circumstance worthy of attention, because it is a danger particularly insisted upon by the opponents of amputation, under the preceding circumstances; and, had it not been for a large abscess, which formed in the back, as was supposed, from a violent blow received in the fall, which produced the original injury, there were well-grounded hopes of recovery. The patient, here spoken of, was attended by Dr. Blicke.

There is likewise a species of gangrene, which is pointed out by Mr. Guthrie, as requiring early amputation. "A soldier (says he) shall receive a flesh-wound from a musket ball in the middle of the thigh, which passed through the limb apparently, on a superficial inspection, without injuring the main artery; or it shall pass close behind the femur, where the artery turns to the back part of the bone; or it may go through the middle of the bone, from behind forwards, between the condyles of the femur into the knee-joint; and the patient shall walk to the surgeon with little assistance, be superficially dressed, and, in many cases, considered slightly wounded; yet, the femoral artery, and vein of the whole of these cases, and, indeed, in many others, shall be wounded, or cut across, and the local inflammation be so slight as to obtain little attention. On the third, or fourth day, the patient shows his toes discoloured, and complains of pain and coldness in the limb below the wound, the constitution begins to sympathize with the injury, and the surgeon probably thinks the case extraordinary. Perhaps, he suspects the real state of the injury; but is surprised that a wound of the femoral, or popliteal artery, with so little attendant injury, could cause mortification, &c. He is anxious to do something; but, mortification, or at least gangrene having commenced, he must, according to general rule, await the formation of the line of separation. The temperature of the leg, a little above the gangrene, is good, perhaps higher than natural; he hopes it will not extend farther, and it probably does remain stationary for a little time. At last, the parts originally affected, the toes, become sphacelated, and gangrene quickly spreads up the leg as far as the wounded artery, by which time the patient dies."

For the purpose of preventing such a disaster, where the artery, or artery and vein have been divided, Mr. Guthrie recommends the performance of amputation, as soon as the gangrene is perceived to extend beyond the toes; and the swelling and and slight attendant inflammation, which is marked more by the tumefaction, than the

redness of the part, has passed higher up, than the ankle. (See *Guthrie on Gunshot Wounds*, p. 60, 61.)

5. *White-swellings.*

Scrofulous joints, with diseased bones, and distempered ligaments, and cartilages, is another case, in which amputation may become absolutely necessary. As Mr. Pott remarks, there is one circumstance attending this complaint, often rendering it particularly unpleasant, which is, that the subjects are most frequently young children, so as to be incapable of determining for themselves, which inflicts a very distressing task on their nearest relations. All the efforts of physic and surgery often prove absolutely ineffectual, not only to cure, but even to retard the disease in question. Notwithstanding many cases admit of cure, there are numerous others which do not so. The disease often begins in the very inmost recesses of the cellular texture of the heads of the bones, forming the large articulations, such as the hip, knee, ankle, and elbow; the bones become diseased in a manner, which we shall explain in the article (*Joints*), sometimes with great pain and symptomatic fever; sometimes with very little of either, at least in the beginning. The cartilages covering the ends of these bones, and designed for the mobility of the joints, are totally destroyed; the epiphyses in young subjects are either partially or totally separated from the said bones; the ligaments of the joints are so thickened, and spoiled by the distemper, as to lose all natural appearance, and become quite unfit for all the purposes for which they were intended: the parts appointed for the secretion of the synovia, become distempered in like manner; all these together furnish a large quantity of stinking sanious matter, which is discharged either through artificial openings made for the purpose, or through small ulcerated ones. These openings commonly lead to bones which are diseased through their whole texture. When the disease has got into this state, the constant pain, irritation, and discharge, bring on hectic symptoms of the most destructive kind, such as total loss of appetite, rest, and strength, profuse night sweats, and as profuse purgings, which foil all the efforts of medicine, and bring the patient to the brink of destruction.

It is an incontestable truth, that, unless amputation be performed, a patient thus situated must perish; and it is equally true, that numbers, in the same circumstances, by submitting to the operation, have recovered vigorous health. (See *Pott on Amputation*.)

It is a fact, highly important to be known, that, in these cases, amputation is attended with more success when performed late than when undertaken at an early period before the disease has made great advances. This is particularly fortunate, as it affords time for giving a fair trial to such remedies as are best calculated to check the progress

of the disorder, and obviate all necessity for the operation. (*Encyclopédie Méthodique*, Tom. 1, p. 83.) See *Joints—White-swelling*.

6. *Exostoses.*

Here it will be sufficient merely to mention, that this disease may render amputation necessary, when the tumour becomes hurtful to the health, or insupportable, on account of its weight, or other circumstances, and cannot be removed by any of the plans specified in the article *Exostoses*.

7. *Necrosis.*

Another distemper, sometimes producing a necessity for amputation, is necrosis, or the death of the whole, or of a very considerable part of the bones of the extremities, accompanied with such extensive abscesses, such disease of the soft parts, such disorder of the constitution, and prostration of strength, that every hope of a cure being effected by a natural process must be renounced. By necrosis, is here meant, not merely some disease, which destroys the surface of a bone, but one which extends its depredations to the whole of the internal substance, and that from end to end. Portions of the bones die from a variety of causes, such as struma, lues venerea, deep-seated abscesses, pressure, &c.; and bones in this state, when properly treated, often exfoliate, and cast off their dead parts. But, when the whole substance of a bone becomes diseased, from end to end, frequently no means will avail. In the words of Mr. Pott, the use of the scalpel, the raspatory, and the rugine, for the removal of the diseased surface of bones; of the trephine, for perforating into the internal texture of the diseased bone, and of exfoliating applications, (if there be any such which merit the name,) will prove in many instances unavailing, and, unless the whole bone be removed by amputation, the patient will die. Mr. Pott's refutation of Bilguer, who asserts that amputation is not requisite in these instances, is a masterly and most convincing production; but I would not exactly do as the former of these writers has done, and positively affirm, that every extensive necrosis, affecting a bone, nearly its whole length, must inevitably require amputation. The power of nature in restoring the bones is sometimes wonderful, as will be hereafter explained. (See *Necrosis*.)

The very late period, at which an extensive necrosis may follow the injury of a bone, and make amputation necessary, is sometimes almost incredible. Schmucker details the case of a captain, who received a musket-ball through the left arm, four or five inches above the elbow. The bone was violently struck, but not broken; several exfoliations followed, and, after more than a year's treatment, the patient appeared perfectly cured. For nine years this officer remained well; but, at the end of this time, being on a journey, he was at-

fected with pain and inflammation in the wounded part, and febrile symptoms. He hastened to Berlin, and put himself under the care of Theden and Schmucker, who found an abscess in the situation of the former wound, and, as an opening had been already made, the bone could be felt stripped of its periosteum. At length, a piece of bone exfoliated, and became loose, precisely under the brachial artery, which interfered with its removal. Notwithstanding the discharge, the elbow-joint continued swelled, and there were red points observable, not only above that joint, but also over the heads of the ulna and radius, indicating disease of those bones. Amputation was therefore performed by Theden, and the patient got quite well. On examining the os brachii, a splinter was found three inches in length, and one in breadth, its edges being thin and sharp, while its centre was more than three lines thick. The bone, every where about the place, where it had been struck by the ball, seemed to consist of callus, without any medullary cavity, and the whole of it down to the elbow had no periosteum. The cartilage appeared also disposed to separate, and the periosteum was detached from the radius and ulna, which were likewise affected with necrosis. (See *Schmucker's Vermischte Chir. Schriften. B. 1, p. 23. Ed. 2.*)

8. *Cancerous and other inveterate diseases, such as fungus hæmatodes.*

Cancerous, inveterate diseases, and malignant incurable ulcers on the limbs, sometimes render amputation a matter of necessity. In treating of cancer, we shall remark that little or no confidence can be placed either in internal or any kind of topical remedies, and that there is nothing, except the total separation of the part affected, upon which any rational hopes of cure can be built. Cancer is not frequently seen on the extremities. Every man of experience, however, must occasionally have seen, in this situation, if not actually cancer, diseases quite as intractable, and which cannot be cured, except by removing the affected part. This may often be accomplished, without cutting off the whole limb. But, when the disease has spread beyond certain bounds, amputation, above the part affected, is the only thing to which recourse can be had with any hope of success. Sometimes when the operation has been delayed too long, even amputation itself will not effect a cure. In a few cases of fungus hæmatodes, the operation has succeeded, however, when the disease had reappeared after a cure had been seemingly achieved by the excision of the diseased parts. Yet, from what I have seen of fungus hæmatodes, I should much doubt, whether the benefit obtained by amputation would be lasting, as when this disease shows itself only externally, internal organs are mostly at the same time similarly affected. (See *Fungus Hæmatodes.*)

Besides cancerous, there are other ulcers,

which may render amputation indispensable. Thus, when an extensive ulcer, of any sort whatsoever, is evidently impairing the health; when, instead of yielding to remedies, it becomes larger and more inveterate; when, in short, it puts life in imminent danger; amputation should be advised.

9. *Various tumours.*

That there are numerous swellings, which destroy the texture of the limbs, rendering them useless; causing dreadful sufferings, and bringing the patients into the most debilitated state, no man of observation can fail to have seen. When such tumours can neither be dispersed, nor cut out with safety, amputation of the limb is the only resource.

Mr. Pott has particularly described a tumour affecting the leg, for which the operation is sometimes requisite. It has its seat in the middle of the calf of the leg, or rather more towards its upper part, under the gastrocnemius and soleus muscles. It begins by a small, hard, deep-seated swelling, sometimes very painful, sometimes but little so, and only hindering the patient's exercises. It does not alter the natural colour of the skin, at least until it has attained a considerable size. It enlarges gradually, does not soften as it enlarges, but continues through the greatest part of it incompressibly hard, and, when it is got to a large size, it seems to contain a fluid, which may be felt towards the bottom, or resting, as it were, on the back part of the bones. If an opening be made for the discharge of this fluid, it must be made very deep, and through a strangely distempered mass. This fluid is generally small in quantity, and consists of a sanies mixed with grumous blood: the discharge of it produces very little diminution of the tumour, and very high symptoms of irritation and inflammation come on, and advancing with great rapidity, and most exquisite pain, very soon destroy the patient, either by the fever, which is high, and unremitting, or by a mortification of the whole leg. If amputation has not been performed, and the patient dies, after the tumour has been freely opened, the mortified and putrid state of the parts, prevents all satisfactory examination; but, if the limb was removed, without any previous operation, (and which Mr. Pott, in his experience, found to be the only way of preserving the patient's life) the posterior tibial artery will be found to be enlarged, distempered, and burst; the muscles of the calf to have been converted into a strangely morbid mass; and the posterior part of both the tibia and fibula more or less carious. (*Pott on Amputation.*)

It seems only necessary to subdue another species of tumour to illustrate the necessity of amputation. The following case is related by Mr. Abernethy! A woman was admitted into St. Bartholomew's Hospital with a hard tumour in the ham. It was about four inches in length, and three in breadth. She had also a tumour in front

of the thigh, a little above the patella, of lesser size and hardness. The tumour in the ham, by its pressure on the nerves and vessels, had greatly benumbed the sensibility, and obstructed the circulation of the leg, so that the limb was very œdematous. As it appeared impossible to remove this tumour, and its origin and connexions were unknown, amputation was performed. On examining the amputated limb, the tumour in the ham could only be divided with a saw. Several slices were taken out of it by this means, and appeared to consist of a coagulable and vascular substance, in the interstices of which, a great deal of bony matter was deposited. The remainder of the tumour was macerated and dried, and it appeared to be formed of an irregular and compact deposition of the earth of bone. The tumour on the front of the thigh was of the same nature as that of the ham, but contained so little lime, that it could be cut with a knife. The thigh bone was not at all diseased, which is mentioned, because when bony matter is deposited in a limb, it generally arises from the disease of a bone. (*Surgical Observations*, 1804.)

Before the late facts and improvements, relative to the treatment of aneurisms, these cases, on the extremities, were generally set down as requiring amputation. Even Mr. Pott, and J. L. Petit, wrote in recommendation of such practice, and their observations on this subject are among the few parts of their writings, which the enlargement of surgical knowledge, since their time, has rendered objectionable. The surgeon to whom the honour of first correcting this erroneous doctrine belongs, is A. N. Guenault, who opposed the advice delivered on this subject by Petit. (*Haller, Disp. Chir. vol. 5. p. 155.*)

I shall conclude these remarks on the cases requiring amputation, with advising surgeons never to undertake this serious operation, without consulting the opinions of other professional men, whenever their advice can be obtained. The best operators are often deficient in that invaluable kind of judgment, by which the cases, absolutely demanding amputation, are discriminated from others, in which the operation may be wisely postponed, and a chance taken of preserving the limb.

Historical Remarks on Amputation.

The history of amputation evinces, that the steps of surgery to perfection are slow, and that they even sometimes deviate from the straight path, though upon all essential points no retrogradation has ever taken place. Here nature has acted as the guide, and the surgeon's chief merit has consisted in obeying the hints which she herself has thrown out. As already mentioned, the following natural occurrence, no doubt, was one of the circumstances, which first led to the bold practice of amputation; in consequence of disease, and grievous local injuries, whole limbs were sometimes seized with mortification. In the majority of ca-

ses, this was attended with so much constitutional disturbance, that the patients died; but, in other less numerous instances, the mortification was confined to the part; suppuration was established between the dead and living parts; the whole of the mortified limb fell off; the suppurating surfaces healed up; and thus, by the powers of nature, the patients were restored to health. Here was clearly proved the possibility of recovery, notwithstanding the loss of a limb. The surgeon, as Brunninghausen remarks, viewed with surprise this course of nature, and hardly ventured to promote it by the feeble means formerly employed, which, however, were not really needed. But, as the mortified parts, previously to their detachment, caused great annoyance by their fetor, a surgical attempt was at length made to get rid of them; in doing which, the knife was always kept from touching the living flesh, on account of a well-grounded fear of bleeding, for the suppression of which no effectual methods were known. Such was the practice that prevailed from Hippocrates down to Celsus. (*Erfahr., &c. über die Amp. p. 14.*) "*Partes autem corporis, quæ infra terminos denigrationis fuerint, ubi jam prorsus emortuæ fuerint et dolorem non senserint, ad articulos auferendæ ea cautione ut ne vulnus inferatur,*" &c. (*De Articulis, sect. 6.*) Here we find, that the earliest mode of amputation was that done at the joints.

A. C. Celsus, who lived in the reign of Tiberius, and whose book, *de Re Medicâ*, should be read by every surgeon, has left us a short description of the mode of amputating the gangrenous limbs. (*Lib. 7. c. 33.*) It has been often remarked, that Celsus has left no instructions for securing the divided blood-vessels; but it has not been commonly noticed, that, in his chapter on wounds, he directs us to stop hemorrhage by taking hold of the vessels, then tying them in two places, and dividing the intermediate portion. If this measure cannot be adopted, he advises the use of a cauterizing iron. Several hints are to be met with in the writings of Celsus, from which it may be inferred, that the ligature of bleeding vessels was sometimes practised at the early age in which he lived; and this supposition is strengthened, by a fragment of Archigenes, preserved by Cœchius, on the subject of amputation, where he speaks of tying, or sewing, the blood-vessels. We are not, however, in possession of all the writings of medical authors, prior to the time of Galen, and must therefore remain in doubt upon this point. (*Rees's Cyclopædia, Art. Amputation.*)

This anonymous writer argues, therefore, with some appearance of reason, that if amputation often proved fatal in the days of Celsus, "*sæpe in ipso opere,*" as the expression is, it was owing to the want of some efficacious method of compressing the blood-vessels, during the operation itself; for, whether the use of the ligature were known to the ancients or not, nō

doubt exists about their ignorance of the tourniquet.

But, admitting that the ancients were not altogether uninformed of the plan of tying arteries, it cannot be credited, that they adopted the practice to any extent; for, if they had, they would not have continued so partial to the cautery, boiling oils, and a farrago of astringent applications. They would also never have had recourse to the barbarous method of cutting the flesh with a red-hot knife, with the view of stopping the hemorrhage by converting the whole surface of the stump into an eschar. Painful in its execution, and horrid in its consequence, as this burning operation was, it seldom proved a lasting antidote to the bleeding, which generally came on in a fatal manner, as soon as the sloughs were loose. On this part of the subject, my own ideas fully agree with those of a distinguished foreign surgeon, who says, that although the document left us may prove that the ligature was known to the ancients, and employed in cases of aneurisms and wounded blood-vessels, nay, that the arteries were secured with a needle and ligature; yet the practice could not have been extended to the operation of amputation, since with the custom of making the incisions in the dead parts, the method scarcely admitted of being put in execution. (*Brünninghausen, Erfahr. über die, Amput. p. 29.*) Ambrose Paré, therefore, seems to me to deserve as much praise for the introduction of the ligature into common use, as if no allusion to this method whatsoever had existed in the writings of Celsus and other ancients.

The different parts of the operation, meriting particular attention, are, the choice of the part of the limb where the incisions are to begin; the measures for guarding against bleeding during the operation; the division of the integuments, muscles, and bones, which is to be accomplished in such a manner, that the whole surface of the stump will afterwards be covered with skin; tying the arteries, which should be done without including the nerves, or any other adjacent part; placing the integuments in a proper position after the operation; and, finally, the subsequent treatment of the wound.

At the period of making the incision, the ancients contented themselves with having the skin forcibly drawn upward by an assistant; they next divided, with one sweep of the knife, the integuments and flesh down to the bone, and, afterwards, sawed the bone on a level with the soft parts, which were drawn upward. Celsus considered it better to let the incision encroach upon the living flesh, than leave any of the diseased parts behind. "*Et potius ex sana parte aliquid excidatur, quam ex ægra relinquatur.*" (*De Medicina, Lib. 7. c. 33.*)

It appears, however, that his views extended further than those of most of his contemporaries, and even his followers, almost down to modern times. After cutting

the muscles down to the bone, he says, that the flesh should be reflected, and detached underneath with a scalpel, in order to denude a portion of the bone, which is then to be sawn as near as possible to the healthy flesh, which remains adherent. He states that, when this plan is pursued, the skin around the wound will be so loose, that it can almost be made to cover the extremity of the bone. It is to be lamented, that this advice, inculcated by Celsus, should not have been comprehended, or that it should have been so neglected, as to stand in need, as it were, of a new discoverer, and that a suggestion of such importance should have remained so long useless. But, the fact is, hemorrhage formerly rendered amputation so dangerous, that the ancient surgeons could not devote much attention to any thing else in the operation, and practitioners amputated so seldom, that we read in Albucasis, that he positively refused to cut off a person's hand, lest a fatal hemorrhage should ensue, and the patient did it himself and recovered. Over that part of the stump, which the small quantity of preserved skin would not cover, Celsus recommended compresses, and a sponge dipped in vinegar to be laid. (*De Re Medica, Lib. 7. c. 33.*)

Archigenes, who was born at Apamia, in Syria, was the disciple of Agathinus, and physician to Philip, king of that country. He repaired to Rome, where he practised physic and surgery, in the reign of the emperor Trajan, about 108 years after the birth of Christ. (*Portal, Hist. de l'Anatomie et de la Chirurgie, Vol. 1, p. 61.*) In the history of amputation, the name of Archigenes is conspicuous, not only because he is supposed to have been acquainted with the use of the needle and ligature for the stoppage of bleeding, but because his description of the operation is in some respects more minute than that of Celsus. For the hindrance of loss of blood in the operation, says Sprengel, (*Geschichte der Chir. B. 1, p. 404, Halle, 1805.*) he first of all tied up the vessels, and often the whole limb over which he also sprinkled cold water. The integuments were then drawn upwards from the wound, and confined there with a band; and after the limb was off, he cauterized the stump, and applied folded compresses. The band was now loosened, and a mixture of leeks and salt laid on the stump, to which were also applied oil and cerate. (*Nicet. Coll. Chir. p. 155.*) Such was likewise the practice of Heliodorus, who thus early made objections to the plan of cutting off a limb by a single stroke, a proposal that was renewed in far later days. The same author has also spoken of amputating at the joints; a method, of which he disapproves. (*Nicet. Coll. Chir. p. 155.*) However, Galen entertained a favourable opinion of it, on account of its safety and expedition. (*Comm. 4, in lib. de artic. p. 650.*) Galen's precepts concerning amputation are, upon the whole, very like those given by Hippocrates; for he directs only dead parts to be cut, and the stump to be

cauterized. (*De Arte Curativa ad Gloucomem*, lib. 2.) By all the old writers, amputation was entirely restricted to cases of mortification; further they were afraid to go; and this precept, and all the other doctrines of Galen, may be said to have been the guide of the whole surgical profession for full fourteen centuries.

The timid Arabians were not partial to amputation, and even in cases of mortification, generally preferred a farrago of useless applications, like Armenian bole, &c. Paulus Aegineta, like Galen, deviated from Celsus's good rule of making the incisions in the healthy parts, and only approved of making the requisite division near them. (*Lib. 4, c. 19, p. 140*.) Avicenna, however, repeated the directions left by the Greek writers, (*Can. lib. 4. Fen. 3, tr. 1, p. 454*.) and Abu'l Kasem proposed doing the operation with a red-hot knife. (*Chirurg. lib. 1. Sect. 52, p. 99*.) In the middle ages, little was done for the improvement of amputation. In the 14th century, gunpowder was invented, and soon applied to the purposes of war, so that an abundance of cases must have presented themselves, in which the wise maxim of not deferring amputation, until mortification had come on, but of preventing the mischief by the operation, ought to have struck an intelligent surgeon. One might also expect that practitioners would now have been led to make the incisions in the sound flesh. Unfortunately, the invention of gunpowder, and its immediate consequences in surgery, happened at a period when practitioners were ill qualified to profit by the new lessons of experience set before them. The writings of their predecessors furnished them with no directions how they ought to act, and they were themselves too much confounded at the sight of the mischief, for which they were consulted, to be able to form any correct opinion about causes and effects. Their first idea was, that the terrible symptoms proceeded from the parts being actually burned, and they afterwards inclined to the belief, that gun-shot wounds were poisoned. Hence, the most absurd modes of treatment were instituted, and as Brunninghausen expresses himself, human nature groaned under a new evil, for which there were for some time no true plans of relief. (*Erfahr. &c. über die Amp. c. 19*.) This deplorable state was the natural result of the depression of science in general, and of the healing art in particular, in the days to which I now refer. In these middle ages, as they are called, the population of all Europe was plunged in the deepest ignorance; and whatever little knowledge remained, either of the arts, or languages, was monopolized by the priesthood, the physicians of those times, who, instead of studying the volume of nature, wasted most of their time in discussing the doctrines of Galen. Surgery itself sunk to the lowest ebb, as may be well conceived from the decrees issued at Rheims, by pope Boniface the eighth, forbidding any of the

clergy to do any thing themselves, which drew blood, and, of course, all the operative part of surgery, that which required most skill and science, was transferred to a set of illiterate, low-bred mechanics, far inferior to the worst country-farriers of modern times. Yet, the clergy, who were here scrupulously averse to soiling their own hands with blood, or hurting their own tender feelings by viewing the agony of their fellow-creatures submitted to operations, had no hesitation in taking the chief emoluments and honours of the profession, or in turning over these poor sufferers to men more qualified to torture and murder, than give relief; and what nearly staggers all credulity, the same professors of christianity, who shuddered to spill a drop of blood themselves, on a proper occasion, as Haller observes, eagerly had a hand, and acted an important part in every sanguinary war, where it was possible for them to interfere. In these dismal days for surgery, the advice delivered by Celsus was renewed by Theodoricus, who used to administer opium and hemlock previously to the operation, for the purpose of rendering the patient less sensible of pain, and afterwards vinegar and fennel were given, with the view of dispersing the intoxicating effects of the preceding medicines. (*Chirurg. lib. 3, c. 10*.)

The renowned Guido di Cauliaco was the inventor of the plan of taking off limbs, without any bloodshed. It is better, says he, for the limb to drop off, than be cut off, as in the latter circumstance, the conduct of the surgeon is viewed with spite, because it is supposed, that the part might have been saved. Guido's practice consisted in covering the whole membrane with pitch-plaster, and applying round one of the joints so tight a band, that the parts below the constriction ultimately dropped off. (*Chirurg. tr. 6, Doctr. 1. Cap. 8*.) As Sprengel next observes, the method of amputating, suggested by Celsus, was again revived by Gersdorf, who after the operation, not only drew down over the stump the skin which had been retracted, but applied a hog's or bullock's bladder over the stump, so as to render all burning and stitching of the parts needless. (*Feldbuch der Wundarszn. fol. 63*.) Bartholomew Maggi also endeavoured to preserve a considerable flap of integuments for covering the stump. (*De Vulner. bombard. et sclopeto. 4to. Bonon. 1552*; see *Sprengel's Geschichte der Chirurgie*, p. 404, 406, 8vo. Halle, 1805.)

At length, in the 15th century, the revival of learning occurred first in Italy. Men now began to think for themselves again, and physicians turned from compilations and scholastic nonsense, to the consideration of nature. Anatomy was cultivated with great ardour, and made brilliant progress under the eminent characters of the time: De la Torre, Berengarius Carpi, Vesalius, Fallopius, Eustachius, and others, who were also for the most part very dis-

tinguished surgeons. "*In Italia scientiarum matre medici se nunquam chirurgia abdicarunt. Seculo 15 et 16, professores medici academie Bononiensis, Palavina, et aliarum in Italia illustrium scholarum et manu curaverunt, et consilio, et inter istos viros summi chirurgi exstiterunt.*" (Haller, *Bibl. Chir.* p. 1. p. 161.) Practitioners now ventured to amputate limbs in the sound part for other incurable diseases, besides mortification; but, the art of stopping hemorrhage after the operation continued imperfect. Though the method of applying the ligature in cases of wounded arteries and aneurisms was understood, yet, from some unaccountable causes, the practice was never thought of in amputations. Even Fallopius knew of no other means for stopping the bleeding, but the cautery. (*De Tum. prætern.* p. 665.) On the whole, the stoppage of bleeding was not attended with a degree of success proportionate to the advances of the healing art in general. Straps, bands, and compresses were indeed put round the member; but, as the circulation of the blood was not yet correctly known, they were not applied in the proper places; being arranged either close to the wound, or several of them put at random round the limb. The effects of such immoderately tight, long-continued constriction, could be nothing less than gangrene, and hence, the actual cautery was still chiefly employed. The other means for suppressing hemorrhage scarcely merit the name. Terrified at the insecurity and ill consequences of such expedients, J. de Vigo, (*Practica in Chirurgia Copiosa*, 491, *Romæ*, 1514,) and Fabricius ab Aquapendente, (*Op. Chir. Venet.* 1619,) disapproved of amputating in the sound flesh, and returned to the principle, inculcated by the ancients, of making the incision in the mortified parts. Others endeavoured to lessen the peril of the bleeding by the rapidity with which the limb was removed, and the instantaneous application of the cautery. For this purpose, L. Botalli invented a sort of guillotine, by means of which a member was severed from the body in an instant, (*De Curandis vulneribus sclopetorum*, *Lugd.* 1560;) while others laid a sharp axe upon the limb, and effected the dismemberment by the blow of a wooden mallet. An example of this barbarous practice is recorded by Fabricius Hildanus, called by his countrymen the patriarch and ornament of the German surgery. In consequence of this fear of bleeding, before he knew of the use of the ligature, he was himself accustomed to amputate with a red-hot knife, the representation of which is given in his work. (*De Gangræna et Sphacelo*, *Op.*) Hildanus became a better surgeon, however, as he grew older, and, in the end, partly contributed to the improvement of amputation, inasmuch as he made the incisions completely in the sound parts, and adopted the method of tying the arteries, as then recently proposed by Paré, but unfortunately, in weak persons he still pre-

ferred the actual cautery to the ligature. (*Op.* p. 814.) One of his inventions was a linen bag, or cap for the stump; and a sort of retractor for holding back the muscles. According to Sprengel, (*Geschichte der Chir.* B. 1, p. 407,) his observations on the pain following the operation, are interesting. (*Op.* p. 807, 814.)

Ambrose Paré, a French surgeon, who flourished in the 16th century, (*Opera, Parisiis* 1582,) and to whom I have already alluded, made some beneficial innovations, with regard to the operation of amputation. It is to his industry, good sense, and skill, that we are chiefly indebted for the abolition of cauterising instruments, and the general use of a needle and ligature for the suppression of the bleeding. (*Lib.* 6, c. 28, p. 224.)

An anonymous writer has given the following account of the practice and opinions of this distinguished surgeon, in relation to amputation. "Paré recommended to cut off the whole of the gangrenous part, if the limb be mortified; but, to encroach as little as possible upon the living flesh. At the same time, he laid it down as a rule, not to leave a very long stump to an amputated leg; because the patient could more conveniently make use of a wooden leg, with the stump only five finger-breadths long, below the knee, than if much more of the flesh were to be preserved. In the arm, however, he left the whole of the living and healthy portion of the member, only separating the diseased part from the sound.

"In preparing for amputation, he directs the skin and muscles to be drawn upwards, and bound tight with a broad bandage, a little above the part, where the incision is to be made. This fillet was intended to answer a threefold purpose: 1st, to afford a quantity of flesh for covering the bone, and facilitating the cure. 2dly, To close the extremities of the divided blood-vessels. 3dly, To dull the patient's feelings, by pressure on the subjacent nerves. When this firm ligature has been applied, Paré directs an incision to be made down to the bone, either with a common large scalpel, or a curved knife. Then, with a smaller curved knife, we are carefully to divide the muscle, or ligament, remaining between the bones of the fore-arm, or leg; after which, we may proceed to saw off the bone as high as possible, and to remove the asperities, occasioned by the saw.

"With the assistance of a curved pair of forceps, he drew out the extremities of the bleeding arteries, either by themselves alone, or with some portion of the surrounding flesh, to be firmly tied with a strong double thread. He now loosened his bandage, brought together the lips of the wound over the face of the stump, and kept them as close as he could, without actual stretching, by means of four stiches, or sutures. If the larger tied vessels should accidentally become loose, he desires the ligature, or bandage, to be again passed round the

limb; or, else, what is better, to let an assistant gripe the limb firm with both hands, and press with his fingers over the course of the bleeding vessel, so as to stop the hemorrhage; then, with a square-edged needle, about four inches long, and a thread, four times doubled, the surgeon must secure the artery in the following manner. Thrust the armed needle into the outside of the flesh, half a finger's breadth from the vessel which bleeds, and bring it out at the same distance from the bleeding orifice; then surround the vessel with the ligature, pass it back again to within one finger's breadth of the place, where it first entered, and tie a fast knot upon a folded slip of linen rag, to prevent its hurting the flesh. By this means, says Paré, the orifice of the artery will be agglutinated to the adjoining flesh so firmly, as not to yield one drop of blood: but, if the hemorrhage were not considerable, he contented himself with the application of astringent powders, &c.

"Thus did this famous surgeon endeavour, by his single example and precepts, to exclude the barbarous use of hot irons in amputation. He says, he knew not of any such practice among the old surgeons; except that Galen recommended us to tie bleeding vessels, towards their origin, in accidental wounds: and he thought proper to do the same in cases of amputation. But, in an apology, at the end of his book, Paré has quoted, in his own defence, a dozen authors, who employed or recommended the ligature before him; and he might have cited many more.

"From the statement we have here given, it may be seen how far the best writers of almost every country have erred in ascribing the original invention of tying arteries to Ambrose Paré. Great merit, indeed, was due to him, for the part he took in extending, and even reviving this incomparable practice: nay, it is not certain, whether any one before him had ever applied the needle and ligature in similar cases, i. e. after amputation; but how very wide of the truth Mr. John Bell's recent account of this matter is, will appear to every person, who will inquire into the facts themselves; for not only were ligatures and needles in use among the ancients, but likewise the tenniculum, or hook to lay hold of the bleeding vessels when they had buried themselves in the muscles. We refer our inquisitive readers to Avicenna, Ætius Albucacis, Brunus, Theodorici, Guido di Cauliaco, John de Vigo, L. Bertapaelia, Tagaultius, Petrus Argillata, Andreas a Cruce, &c. &c. where they will find enough to satisfy them on this head." (*Rees's Cyclopædia*, art. *Amputation*.)

I shall not here expatiate upon the ill-treatment, which Paré experienced from the base and ignorant Gourmelin; nor upon the slowness and reluctance, with which the generality of surgeons renounced the cautery for the ligature. These circumstances may be conceived from what has been already stated. Suffice it to add, upon the authority of Dio-

nis, that, almost 100 years after Paré, a button of vitriol was ordinarily employed in the Hôtel Dieu at Paris for the stoppage of hemorrhage in amputation. And Dionis was the first Frenchman, who openly taught and recommended Paré's method. This however happened towards the close of the 17th century, while Paré lived towards the end of the 16th. (*Dionis Cours d'Opérat. Paris 1707.*)

As Paré, like the rest of the old surgeons, used to cut directly down to the bone, many of the stumps, which he made, must have been badly covered with flesh, and ill-fitted for bearing pressure. But, all that I have read on the subject of amputation impresses me with a strong conviction, that, in former times, the projection of the end of the bone, the sugar-loaf form of the stump, the frequent exfoliations, and the difficulty in healing the part, and keeping it healed, were as much owing to the mischief done with the cautery, the rude way of dressing the stump, and ignorance of the right method of promoting union by the first intention, as to the mode of operating, or any other circumstance.

By many surgeons, however, the tying of arteries continued to be deemed too troublesome, and hence, they persisted in the barbarous use of the actual cautery: of this number were Pigras, (*Epitome des Préceptes de Med. et de Chir. 8vo. Rouen, 1642.*) F. Plazzone, (*De Vuln. Sclopet. 4to. Venet. 1618.*) and P. M. Rossi, (*Consult. et Observ. 8vo. Francof. 1616.*) Nay, so difficult was it to eradicate the blind attachment to the ancients, that Theodoros Baronius, a professor at Cremona, publicly declared in 1609, that he would rather err with Galen, than follow the advice of any other person; and Van Hoorne seems even to have countenanced the detestable machine of Botalli. (*Μηγορέχην*, p. 75.)

What, asks Brünninghausen, was the reason why the ligature of the arteries, which is now regarded by the surgeons of all civilized nations, as the best, easiest, and safest method of stopping hemorrhage after amputation, should so long have remained undepicted? Besides the prejudice for the opinions of the ancients, already mentioned, another cause was undoubtedly the imperfect knowledge of the circulation of the blood, a correct description of which was first delivered by the immortal Harvey early in the 17th century. (*Exercitatio Anat. de Mortu Cordis et Sanguinis in Animalibus. Francof. 1628.*) For some time, this grand discovery met with violent opposition; but, after it had been acknowledged as an eternal truth, a happy application of it was made to surgery by a French surgeon, named Morell, who at the siege of Besancon in 1674, invented the field-tourniquet, by means of which more certain pressure was made on the trunk of the artery. By this simple invention, founded however on a knowledge of the circulation, the surgeon could at option let the blood of

the stump spirt out, or stop its jet entirely; and now, both during and after the operation, he was first enabled to command the hemorrhage, and coolly and judiciously employ whatever measures were indicated; for the most powerful bandages and pressure, previously in use, either stopped the circulation in the whole limb, or could not be made to have the right effect with sufficient quickness. (*Brünninghausen Erfahrung. &c. über die Amp. p. 36.*) Morell's tourniquet, however, was very imperfect, and it was not till the year 1718, that J. L. Petit, whose name shines so brightly in the history of surgery, invented the kind of tourniquet now employed.

Richard Wiseman, who is justly considered as the father of good English surgery, saw the necessity of making the incision in the sound parts, because gangrene does not always spread evenly, but frequently extends much higher up one side of the limb, than the other. He deemed the actual cautery objectionable, as the sloughs were so long in being thrown off. He applied a ligature round the limb, two inches above the limits of the mortification, and drawing up the muscles, made the incision with a large curved knife, with the back of which he scraped off the periosteum. The bag, or sort of retractor, employed by Fabricius Hildanus, Wiseman thought unnecessary, as the muscles spontaneously drew themselves up as soon as divided. He tied the blood-vessels after the manner of Paré, and deprecated all burning of the stump. After the operation, he drew the flaps over the bone, and either fastened them in this position with stiches, or a tight bandage, though he generally preferred the former, as the surest means of keeping the end of the bone from protruding. Across the stump, he laid a pledget of wax-cerate, and over this a thick layer of Armenian bole and other styptics, and the whole was covered with a bullock's bladder, and a roller applied spirally from the upper part of the remaining portion of the limb, down to the extremity of the stump. On the third day, the dressings were taken off, and a digestive ointment applied. (*Chirurg. Treatises, vol. 2, p. 220, 8vo. Lond. 1690.*)

From this time, amputation may be considered as being an infinitely safer proceeding, than what it used to be; for, as we have explained, the ligature of the arteries was now practised and commended in Germany by F. Hildanus, in England by Wiseman, and in France by Dionis. Much however remained to be done. The wound was large, and suppurated long and profusely; the healing was slow; the ends of the bones perished, and projecting far beyond the soft parts, retarded the cure so long, that the patient was not unfrequently worn out. Hence the best surgeons began seriously to consider what further could be done, with the view of lessening the exposed surface of the wound, and making a

better covering of flesh for the ends of the bones.

According to Sprengel, most of the old surgeons preserved a flap of flesh, and he is therefore by no means disposed to regard our countryman Lowdham, as the inventor of this method, though it is acknowledged, that the latter surgeon's practice was novel, inasmuch as the flap was formed by making an oblique incision through the integuments from below upwards. (See *James Yonge's Currus Triumphalis e Terebintho, 8vo. Lond. 1679, and Sprengel's Geschichte der Chirurgie, B. 1. p. 408.*) Here, if Sprengel means, that many of the old surgeons endeavoured to preserve a partial covering of flesh for the bone, there can be no doubt of his correctness, because we find, that they drew back the flesh before they divided it, and Celsus and some others even did more, for, after cutting down to the bone, they detached the flesh further from it upwards, previously to taking the saw; but, on the contrary, if Sprengel wish us to believe, that there were practitioners, who previously to Lowdham, in the operation of amputation, formed what in England is usually understood by a flap, that is, a portion of flesh, generally of a semilunar shape, and saved particularly from one side of the member for covering the bone, I cannot see any reason for coinciding with Sprengel's observation. Upon the merit of Lowdham's suggestions, and the practice and principles inculcated by J. Yonge, some reflections lately sent me by Mr. Carwardine, I insert with great pleasure, as perhaps he is right in thinking, that the last edition of this work did not do justice to the memory of the latter writer.

"At the time Yonge wrote (1679) says Mr. Carwardine, it was supposed impossible to heal a stump before the bone had exfoliated, and therefore, no surgeon would venture upon an attempt at uniting the surface by the first intention. Now this union by the first intention, was the chief object of Mr. Yonge in proposing the flap operation, and it is to him, and not to Mr. Alanson, who wrote precisely 100 years after him, that we must attribute the honour of this improvement. It is related in a letter addressed to his friend Thomas Hobs, chirurgion in London, dated Plymouth, August 3, 1678, and published 1679, at the end of his *Currus Triumphalis e Terebintho*. It begins thus:—

"Sir, I find by yours that you are surprised with the intimation I gave you, of a way of amputating large members, so as to be able to cure them *per symphysin* in three weeks; and without fouling or scaling the bone. It is a paradox which I will now evince to you to be a truth, after I have first taken notice of what you affirm, that there is a necessity of scaling the ends of those bones left bare after the usual manner of dismembering before the stump can be soundly cured; that you never yet found it otherwise, but that where it hath been attempted, the stumps have apos-

tumated, and the caries come off thereby.

"Yonge then acknowledges, that it was from an ingenious brother, Mr. C. Lowdham of Exeter, that he had the first hint thereof. He then describes the operation—the laying down the flap over the face of the stump, and sewing it by four or five stitches, &c. After this Yonge proceeds with a methodical enumeration of the advantages of this mode of operating over all others then in use, viz. that it is more *speedy*—the cure not occupying a *fourth of the usual time*—no *suppuration*—no *exfoliation*—less danger of hemorrhage—not liable to break open again from slight injury—and lastly, much better adapted to the pressure from an artificial leg, &c.

"The foregoing abstract will show, (says Mr. Carwardine,) how far Mr. O'Halloran's method, presently to be described, in which he dresses the flap and the stump as distinct surfaces, can be regarded as a revival of Lowdham's operation, or whether it has been superseded or improved upon by the *mechanical ingenuity* of the Dutch and French surgeons. The apparatus of M. de la Faye and Verduin appear to have been merely clumsy and unscientific contrivances for the suppression of hemorrhage. Garengeot's operation had also for its object to supersede the use of the ligature, which, however, after twelve years practice, he was obliged to give up, and tie the vessel before he laid down the flap: (the particulars of all these methods the reader will presently meet with.) Opinions therefore founded upon the practice of these gentlemen, I conceive cannot fairly be admitted as evidence against the flap operation of Lowdham, which nevertheless appears sinking in the estimation of the best modern surgeons: perhaps no material advantage is gained by it over the common mode of operating in the *lower extremities*, as now practised; but, even here, cases may occur where we are glad to resort to it. A few years since, I attended a patient, in consultation with a friend at Dunmow, in Essex, where we thought it necessary to remove a man's leg for a caries of the tibia. An ulceration in front extended so high, that no integument could be saved; and the limb would have been removed above the knee, if I had not suggested the propriety of making a flap from the calf of the leg. The tibia was obliged to be sawn as high as possible, but the flap was left sufficiently long to cover the surface, and that most important object, the bend of the knee, was preserved to bear the pressure of a wooden leg. In the removal of the arm at the shoulder joint, doubtless the advantages of making a flap from the deltoid, &c. are sufficiently established; but, in the mode of dressing, I presume, that no English surgeon will admit, that the practice of M. Larrey (perhaps the most eminent surgeon that has been formed by the wars of Bonaparte, and whose practice will be hereafter noticed,) can supersede the method of Yonge (or

Lowdham,) who wrote 140 years before him! Larrey introduces charpie beneath the flap to *prevent union* by the first intention! Lowdham's object is simply to lay the flap over the wound to prevent exfoliation, and to heal the surface '*per symphisin*' in three weeks." To the correctness of these sentiments of Mr. Carwardine, I believe, that every impartial surgeon will bear witness; and it merely remains for me to thank him for his obliging communication, and say, that I have recently looked over the copy of the *Currus Triumphalis e Te-rebintho*, preserved in the valuable library of the Medical and Chirurgical Society, and find, that what he has stated is fully confirmed by the contents of that ancient work. At the same time, I retain the belief, that the example set by Mr. Alanson, with respect to the proper method of dressing stumps, and obtaining a speedy union of the wound, is entitled to the praise of posterity, because his advice was so well enforced that it soon produced a revolution in practice; while the correct suggestions of Lowdham and Yonge, like the hint in Celsus, of the double incision, had sunk into oblivion, or were only known to a few admirers of surgical antiquities.

As Sprengel remarks. Purmann, Dionis, (*Cours d'Opér. de Chir. p. 611.*) De la Vauguyon, (*Traité Compl. des Opér. de Chir. p. 531.*) and most other surgeons of the seventeenth century, continued the method of first drawing up the integuments, and then applying a band round the member. Dionis also took particular pains to recommend the ligature of the vessels, and expresses a strong aversion to the actual cautery. Neither did he approve of amputation at the knee joint, because he thought that the patella, which must be left behind, would impede the healing of the stump, and he was apprehensive of the articular surface of the femur becoming diseased. De la Vauguyon relied upon the styptic properties of vitriol, and he praised drawing back the muscles by means of the kind of bag invented by Fabricius Hildanus.

Taking off the limbs at the joints was first commended again in modern times by J. Munnicks, who was more partial to styptics, than the ligature; and for dressing the wound employed compresses and sticking plaster. (*Chirurgia, p. 101.*)

Marquest de la Mothe adopted the plan of operating recommended by Dionis; he was also one of the first who made common use of the tourniquet in amputations, afterwards drawing out the vessels with the forceps and tying them. (*Traité Compl. de Chir. Vol. 3. p. 171.*) Lowdham's original suggestion of amputating with a flap has been briefly noticed. About eighteen years after Yonge's publication, Peter Verduin, an eminent surgeon at Amsterdam, submitted to the judgment of the profession a new kind of flap amputation, which he had put in practice. (See *Dis. Epistolica de Nova Artum deurtandorum ratione, &c.*

Amst. 1696.) The following are the chief particulars of Verduin's flap operation.

Two compresses were applied, one under the ham, and the other on the course of the large vessels. The thigh was wrapped in a fine linen cloth, which was sustained by some turns of a roller. This apparatus was covered with a piece of leather, six inches broad, furnished with three straps with buckles, to secure it round the part. The tourniquet was placed in the usual manner. The part, above the place intended to be amputated, was surrounded with a leather strap. The point of a crooked knife, which was made to pass as near to the back part of the bones as possible, was thrust in on one side of the leg, and made to come out on the other. The knife was then carried down nearly to the tendo achillis, and thus it separated almost the whole calf of the leg. The flap being formed, the operation was finished in the ordinary manner. The wound was then washed with a wet sponge, in order to clear it from the fragments of sawn bone. The leather strap, which served to secure the flesh, was next loosened, and the flap laid over the stump. The wound was dressed with lycoperdon, lint, and tow, over which was put a bladder, sustained by strips of sticking-plaster. Upon this bladder was placed an instrument, called a *retinaculum*, consisting of a compress, and a concave plate, which were made to press upon the stump, by means of two straps, that crossed each other, and were attached to the broad leather strap surrounding the thigh.

In 1702, Sabourin, an able surgeon at Geneva, gave an account of Verduin's practice to the Royal Academy of Sciences, which, however, declined to pronounce any judgment about it, without further experience.

Though this method of amputation was objected to by K  nerding, in a tract published at Amsterdam in 1705, it was afterwards highly extolled by P. Massuet, on account of the quickness with which the stump healed, the safety with which the flap served for the stoppage of the hemorrhage, and the avoidance of exfoliation by the non-exposure of the bone. He also dwelt upon the excellency of the stump for the application of an artificial foot. (*De l'Amputation    lambeau*, 8vo. Paris, 1756.) Heister disapproved of the flap amputation, because it appeared to him, that the irritation of the flesh by the projecting bones was apt to cause pain and inflammation: he operated himself after the manner of Dionis, and was strongly in favour of the use of ligatures.

Some excellent precepts were delivered by J. L. Petit concerning amputation. He improved the tourniquet; and, instead of the large crooked amputating knife, formerly employed, first brought into use the straight more moderate-sized knives with sharp backs, now seen in the hands of the best surgeons, because much better calculated than crooked knives, for dividing the

flesh by a sawing movement, which is the only right and surgical way of attempting to cut any part of the human body. He proved that making the division in the mortified parts was frequently followed by hemorrhage; and for the suppression of bleeding he thought it the best principle to promote the formation of a coagulum. (*M  m. de l'Acad. des Sciences*, an. 1732, p. 285. See *Hemorrhage*.) For compressing the vessels, he employed an instrument, which covered the stump, like Verduin's *retinaculum*, and made pressure by means of a screw. His only objection to Verduin's method was, that the extension of gangrene up the limb frequently hindered the formation of so large a flap. He laid down the valuable general maxim of always removing as much bone, and as little flesh, as possible; for which purpose, he invented what is termed the *double incision*, or dividing the business of cutting through the soft parts into two stages. About an inch higher than the place where he meant to saw through the bones, he first made the circular cut through the integuments down to the muscles; the skin was then pulled up so as to leave the flesh uncovered to the extent of an inch, and the muscles were now divided at the highest point of their exposure. Lastly, the flesh was held out of the way with a retractor, and the bone was sawn through high enough up to allow of its extremity being well covered with flesh and integuments. The greatest defect in the doctrines of Petit, relative to amputation, was the confidence he put in pressure, instead of the ligature. (*Traite des Malad. Chir.* vol. 3, p. 126.) The first performance of amputation at the shoulder-joint, by Le Dran, and the improvements and alterations of that operation suggested by Gareng  ot, De la Faye, Desault, &c. I shall notice in a future section.

In chronological order, the next event claiming notice, in the history of amputation, was the promulgation of an opinion by T. R. Gagnier, that Verduin's flap-amputation might be traced back to times of great antiquity, the method described by Celsus being very similar. (*Haller, Diss. Chir.* vol. 5, p. 161.) On this point, with reference to Lowdham, the true inventor of the flap-operation, I have already delivered my own sentiments.

The flap-amputation of the leg, after Verduin's manner, was tried by De la Faye, who found that the pressure of the flap was not enough to check bleeding from all the vessels, as it only operated on the anterior tibial artery, and, by pressing the flesh more firmly against the end of the bones, he thought the risk of mortification would be occasioned.

Verduin, and Sabourin, as we have seen, made only one flap. Two French surgeons, Ravaton and Vermale, afterwards thought, that it would be better to save a flap from each side of the limb. They were also advocates for tying the vessels, and bringing the two flaps into contact, so as to

procure their speedy union, and prevent exfoliations and profuse suppuration.

However, there is some difference in their methods of forming the flaps. Ravaton, who submitted his plan to the French Academy in 1739, made three deep incisions down to the bone; first, a circular one, with a crooked knife, within four finger-breadths of the bone intended to be sawn; and then with a somewhat larger knife; the two others perpendicularly to the first, one at the forepart, and the other at the back of the limb; and, taking care not to touch the principal vessels, he detached the two flaps from the bone.

Vermale formed the separate flaps by two incisions. After applying the tourniquet, he surrounded the part with two red threads, at the distance of four finger-breadths from each other; one at the place where the bone was to be sawn; the other at the place where the incision of the flaps was to terminate. He afterwards thrust a long bistoury down to the bone, at the forepart of the limb; turned it round the circumference, so that it might come out at the opposite part; then directing the edge of the knife along the bone, he cut down to the inferior thread, where he separated the first flap, which, as the author says, was of a round or conical figure at its extremity. The second flap was made in a similar way on the interior side of the member. (*Traité des Playes d'Armes à feu, par Ravaton, 8vo. Paris, 1750; De la Faye, in Mém. de l'Acad. de Chir. T. 5, ed. 12mo. Vermale, Obs. de Chir. 8vo. Manheim 1767.*)

In presence of M. Quesnay, Garegeot performed the flap amputation according to the method of Verduin and Sabourin. We know, that they made no ligature on the vessels, and that their intention was, that the flap, when applied to the stump, and sustained by a particular apparatus, should reunite, and stop all bleeding.

Garegeot's patient died on the third day after the operation; and hemorrhage was allowed to have had a considerable share in producing death.

The multiplicity of machines described by Verduin, La Faye, &c. had no other end, but that of keeping the flap near the orifices of the vessels, so as to compress and close them. Garegeot reflected that, to obtain a just degree of this compression was very difficult, as the most considerable vessels were situated between the two bones, and, in general, when cut, withdrew themselves. Hence, he determined in future to employ ligatures.

With these views, twelve years after the foregoing case, Garegeot performed a flap amputation of the arm, preserving two flaps, according to the method communicated to the Academy by Ravaton. The brachial artery was tied, and the patient got well, without any exfoliations.

Garegeot made a third trial of this operation on a soldier dangerously wounded

in the right foot by the bursting of a bomb, which fractured the interior part of the two bones of the leg, and several of the foot: the patient got well in twenty-seven days.

In this operation, one single flap was made. Garegeot was fearful, however, that the quick union might create some difficulty of withdrawing the ligatures, and he therefore took a means of hindering adhesion where they were situated; but, of this objectionable plan, I shall not speak. He rightly preferred dressing and bandaging the stump to the use of the compressing machines invented by Verduin and La Faye; and his choice of a straight knife, instead of a crooked one, was equally judicious.

The preceding case dictated a truth, which will last as long as surgery itself,—viz. that it is advantageous to apply the ligatures in such manner as to embrace no more than the vessel, so that they may fall off the sooner, and the parts more quickly unite. (*M. de Garegeot, in Mémoires de l'Acad. de Chirurgie, Tom. 5, in 12mo.*)

At one time, a frequent objection, urged against the foregoing methods, was, that, when the fresh-cut flap was immediately laid over the stump, inflammation and abscesses were apt to ensue. Hence, in 1765, Sylvester O'Halloran, a surgeon at Limerick, was led to make the experiment of deferring laying down the flap till the end of the first eight, or twelve days after the operation, when it was conjectured that the risk of inflammation and abscesses might be abated. The tenor of Mr. O'Halloran's book is apparently corroborated by the facts brought forward. Here we see one of the grand points, insisted upon by our worthy countryman James Yonge, viz. the chance of an immediate union of the wound from laying down the flap without delay, suddenly given up, and because the wound could not always be healed without suppuration, it was determined that it never should do so. However, it is consolatory to find, that O'Halloran's suggestion only now exists in the history, and not in the practice of surgery. Alexander Monro, senior, was a great opposer of certain methods, which originated among the French surgeons, and, in particular, he disapproved of the tourniquet: he secured the vessels with needles and ligatures; and was the inventor of a bandage, which has been extensively approved of under the name of Monro's roller. (*Medical Essays of Edinb. Vol. 4, p. 257.*)

Bromfield, like Le Dran, restricted amputation to a few cases; and he did not acknowledge its necessity, as a matter of course, in every case of gangrene, much less in every instance of white-swelling, or caries. From a passage, which I have cited from Dr. Rees's Cyclopadia, it would seem that the tenaculum was known to the ancients; yet, according to general opinion, (and I cannot affirm that it is incorrect from any passage in my recollection,)

Bromfield is allowed to be the first surgeon who employed this very useful instrument. (*Chir. Cases and Obs. Vol. 1, p. 41, Soc. Lond. 1773.*)

About the year 1742, the removal of thighs without bloodshed, was a subject a good deal broached. A single case, recorded by Schaarschmid, where a mortified thigh separated without hemorrhage, was the foundation of the scheme. The arteries were completely blocked up, and the parts insensible. (*Haller, Dis. Chir. Vol. 5, p. 155.*) A similar occurrence was related by Acrel (*Chir. handels. p. 557*;) and Lalouette professed himself a believer in the security from hemorrhage, on account of the vessels being filled with coagula, and approved therefore of letting dead parts be removed, or rather fall off, without bloodshed. (*Haller, Diss. Chir. Vol. 5, p. 273.*)

Bagieu, an experienced French military surgeon, in cases where the projecting bone of the stump was affected with necrosis, ventured to amputate a second time, and urged a variety of arguments in defence of the practice. (*Mém. de l'Acad. de Chir. T. 2, p. 274.*) He coincided with Le Dran and Bromfield, however, about the propriety of restricting amputation to few cases, and has related numerous examples of limbs being saved, which, according to the doctrines then in vogue, ought to have been cut off. (*Deux Lettres d'un Chir. de l'Armée, 12mo. Paris, 1750.*)

M. Louis, a French surgeon of extraordinary talents, introduced the plan of dividing the loose muscles first, and lastly those which are closely connected with the bone. This eminent man took notice, that the muscles of the thigh became retracted in an unequal degree, after being divided. Those which are superficial, and extend along the limb, more or less obliquely, without being attached to the bone, were drawn up with greater force, and in a greater degree, than others, which are deeply situated, in some measure, parallel to the axis of the femur, and fixed to this bone throughout their whole length. The retraction begins the very instant when the muscles are cut, and is not completed till a short time has elapsed. Hence, the effect should be promoted, and be as perfect as possible, before the bone is sawn. In the amputation of the thigh, M. Louis was always desirous of letting the muscles contract as far as they could, and, for this reason, he was rather averse to using the tourniquet, as the circular pressure of this instrument rather counteracted what he wished to take place, and hence he at one time preferred letting an assistant make pressure on the artery, though he subsequently expressed his approbation of the tourniquet proposed by M. Pipelet for compressing the femoral artery. (*Mém. de l'Acad. de Chir. Vol. 4, p. 60, 4to.*)

Actuated by such principles, M. Louis practised a kind of double incision different

from that of Cheselden and Petit, and different also from Alanson's method, which I shall hereafter notice. By the first stroke, he cut, at the same time, both the integuments and the loose superficial muscles; by the second, he divided those muscles, which are deep, and closely adherent to the femur. On the first, deep, circular cut being completed, M. Louis used to remove a band, which was placed round the limb, above the track of the knife. This was taken off, in order to allow the divided muscles to become retracted without any impediment. He next cut the deep adherent muscles, on a level with the surfaces of those loose ones, which had been divided in the first incision, and which had now attained their utmost state of retraction. In this way, he could evidently saw the bone very high up, and the painful dissection of the skin from the muscles was avoided. M. Louis was conscious, that there was more necessity for saving muscle than skin; and he knew, that, when an incision is made at once down to the bone, the retraction of the divided muscles always left the edge of the skin projecting a considerable way beyond them. Hence he deemed the plan of first saving a portion of skin, by dissecting it from the muscles, and turning it up, quite unnecessary. As the bone should always be sawn rather higher than the division of the soft parts, Louis, like J. L. Petit, and most other judicious surgeons, highly approved of the employment of a retractor. He was likewise the author of some valuable instructions for preventing the protrusion of the bone after the operation. (*See Mém. de l'Acad. de Chir. T. 2, p. 268—410, &c. 4to.*) The impartial reader, who takes the trouble to read the remarks on amputation, published by this greatest of all the French surgeons of the last century, with the exception perhaps of J. L. Petit, and Desault, will at once be impressed with the force and perspicuity of his matter, and with the evident propriety of a good deal of the practice inculcated.

In England, Cheselden, and not J. L. Petit, is regarded as the surgeon who revived Celsus's method, in proposing to divide the soft parts by a double incision; that is, by cutting the skin and cellular substance first, and then, by dividing the muscles, down to the bone, on a level with the edge of the skin, so that the bone might be sawn higher up, and its end be more completely covered with skin. Whether Cheselden had the priority in this improvement, I cannot presume to say; but, he gave an account of it in Gataker's translation of Le Dran's treatise on the operations, as early as 1749, which was long prior to the appearance of Petit's posthumous writings; and Mr. Cheselden further mentions, that, during his apprenticeship to Mr. Fern, he had communicated to that gentleman his sentiments about the double incision.

In order to hinder the stump from assuming a pyramidal, or sugar-loaf shape,

which sometimes happened notwithstanding every improvement hitherto mentioned, a circular bandage was employed, which acted by supporting the skin and muscles, and preventing their retraction. This bandage, when properly applied, from the upper part of the limb downward, fulfilled, in a certain measure, the end proposed, though many stumps yet turned out very badly. Mr. Sharp was induced therefore to revive the very ancient plan of bringing the edges of the skin together with sutures; but, the pain and other inconveniences of this method were such, that it was never extensively adopted; and Mr. Sharp himself ultimately abandoned it. The cross bandage, however, which he used to put over the end of the stump, remains in fashion even at the present day. (*Treatise on the Oper.* p. 216; *Critical Inquiry*, p. 268.) It is to be regretted, that an excellent modern surgeon, the late Mr. Hey, should have commended so much as he has done the use of sutures, in bringing together the edges of the wound after amputation. (*Practical Observations in Surgery*, p. 534. *Edit.* 2.)

In opposition to Louis, the inefficiency of his method for hindering the protrusion of the bone was asserted by Valentin, who thought the object might be better attained by dividing the parts while they were in a state of tension; for which purpose, he recommended changing the posture of the limb, according to the parts which he was about to cut. (*Récherches Critiques sur la Chirurgie moderne*, *Svo.* Amst. 1772.) Valentin's proposal seems never to have made much impression on the profession; whether on account of its inconvenience, or inefficacy, I know not: certain it is, many cases present themselves, in which the posture of a limb absolutely could not be changed during the operation, owing to the nature of the disease, or could not be altered without extreme agony to the patient.

At this period arose the celebrated controversy about the propriety of amputation in general. As Sprengel remarks, several French surgeons now began to be convinced, with Le Dran and Bagieu, that the operation was undertaken on too light grounds, and, in particular, that bad complicated fractures might be healed very well without amputation. Such was the doctrine of Boucher (*Mém. de l'Acad. de Chir.* T. 2, p. 304), Gervaise (*Anfangsgr. der Wundarzn.* *Svo.* Strassb. 1755.) and Faure (*Mém. qui ont concouru pour le prix de l'Ac. de Chir.* Vol. 1, p. 100.) The latter especially urged the prudence of delay, in gun-shot wounds, and comminuted injuries of the bones. But, the writer, who at this time made most noise in the world, by his general condemnation of amputation, was Bilguer, (*Diss. de Membrorum Amputatione*, *Svo.* Hal. 1761.) whose sentiments have received so complete a refutation from his own contemporaries, Pott, (*Chir. Works*, Vol. 2.) Morand, (*Opusc. de Chir.* T. 1, p. 232.) and de La Martinière (*Mém. de l'Acad.*

de Chir. Vol. 4, p. 1.) and also from later writers, to whom reference will be made in speaking of *Gun-shot Wounds*. Even Bilguer himself was compelled to admit the necessity of amputation in cases of gangrene. (*Anweis für die Feldwundärzte*, S. 170.)

Bilguer's colleague, the celebrated Schmucker, inclined to the same doctrines, and has detailed several cases, where limbs were not only shattered, but actually carried away by balls, yet where a cure followed without amputation. One of his maxims was, that it was better for the member to be taken off by gun-shot, than by the surgeon's knife, as the ball operated on a healthy subject, the knife on a person debilitated by an hospital. (*Chir. Wahrn.* Th. 2. S. 493.) In a later valuable essay on this subject, he restricts amputation to shattered limbs, affected with gangrene. His mode of operating was that of M. Louis. He sanctioned joint-operations at the hip and shoulder; but condemned those of the knee and elbow, as never answering. (*Verm. Schrift.* Th. 1. S. 3.)

Soon after the middle of the last century, the practice of amputating at the joints began to excite increased attention; but, as this is a topic, to which I must presently return, it is unnecessary now to dwell upon it. The writings of Puthod, Wohler, Brasdor, Barbet, Sabatier, Park, Moreau, and Vermandois, in relation to this subject deserve particular notice.

I now come to Mr. Alanson, whose name cuts as great a figure in the history of amputation, as that of any surgeon yet mentioned. His chief objects were to hinder a protrusion of the bone, and promote union by the first intention. He rejected the band, which used formerly to be put round the limb for the guidance of the knife, as altogether useless, and an impediment to the quick performance or the circular incision through the skin. When the tourniquet had been applied, an assistant grasped the integuments with both hands, and drew them and the muscles firmly upwards. The operator then fixed his eye upon the proper part, where he was to begin the incision, which was made with considerable facility and despatch, the knife passing with greater quickness in consequence of the tense state of the integuments.

After the incision through the integuments, the assistant still continued a steady support of the parts, while Mr. Alanson separated the cellular and ligamentous attachments with the point of his knife, till as much skin had been drawn up as would, with the united assistance of the particular division of the muscles hereafter recommended, fully cover the whole surface of the wound. Then, instead of applying the knife close to the edge of the integuments, and dividing the muscles in a circular perpendicular manner down to the bone, Mr. Alanson proceeded as follows: when operating upon the thigh, and standing on the outside of the limb, he applied the edge of his

knife, under the edge of the supported integuments, upon the inner margin of the vastus internus muscle, and cut obliquely through that and the adjacent muscles, upwards as to the limb, and down to the bone, so as to lay it bare, about three or four finger-breadths higher than is usually done, by the common perpendicular circular incision. He now drew the knife towards himself, then keeping its point upon the bone, and the edge in the same oblique line already pointed out for the former incision, he divided the rest of the muscles in that direction all round the limb; the point of the knife being in contact with, and revolving round the bone through the whole of the division.

According to Mr. Alanson, the speedy execution of the above directed incision, will be much expedited, by one assistant continuing a firm and steady elevation of the parts, and another attending to preserve the skin from being wounded, as the knife goes through the muscles, at the under part of the limb. Mr. Alanson censures the old method of depriving the bone of its periosteum to a considerable extent, above and below the part, where he saw was to pass, not only as creating unnecessary delay, but since the periosteum serves to support the vessels in their passage to the bone, as apt to produce exfoliations, above the part where the bone is to be divided with the saw. Instead of this practice, he advises first the application of the retractor, as advised by Gooch and Bromfield; and then denuding the bone at the part, where the saw is to pass, whereby the bone may be sawn off higher than is usually practised; a material object in preventing a projection of the bone, and forming a small circatrix.

If the flesh of a stump, formed in the thigh, agreeably to the foregoing plan, be gently brought forward after the operation, and the surface of the wound be then viewed, it may be said to resemble in some degree, a conical cavity, the apex of which is the extremity of the bone; and the parts thus divided, are obviously the best calculated to prevent a sugar-loaf stump.

The part where the bone is to be laid bare, whether two, three, or four finger-breadths higher than the edge of the retracted integuments; or, in other words, the quantity of muscular substance to be taken out, in making the double incision, must be regulated by considering the length of the limb, and the quantity of skin that has been previously saved by dividing the membranous attachments. The quantity of skin saved, and muscular substance taken out, must be in such exact proportion to each other, that the whole surface of the wound will afterwards be easily covered, and the limb not more shortened, than is necessary to obtain this end.

After the removal of the limb, Mr. Alanson drew each bleeding artery gently out with the tenaculum, and tied it as nakedly as possible, with a common slender ligature. When the large vessels had been tied, the tourniquet was immediately slackened, and

the wound well cleaned, in order to detect any vessel, that might otherwise have remained concealed with its orifice blocked up with coagulated blood; and before the wound was dressed, its whole surface was examined with the greatest accuracy, by which means Mr. Alanson frequently observed a pulsation, where no hemorrhage previously appeared, and turned out a small clot of blood from within the orifice of a considerable artery. He urges bestowing particular attention in making every vessel secure which is likely to bleed on the attack of the symptomatic fever; for besides the fatigue and pain, to which such an accident immediately exposes the patient, it seriously interrupts the desired union of the wound. He used always to clean the whole surface of the wound well with a sponge and warm water, as he thought, that the lodgment of any coagulated blood would be a considerable obstruction to a quick union of the parts.

The skin and muscles were now gently brought forwards; a flannel roller was put round the body, and carried two or three times rather tightly round the upper part of the thigh, as at this point, it was intended to form what Mr. Alanson called a sufficient basis, which materially added to the support of the skin and muscles. The roller was then carried down in a circular direction to the extremity of the stump, not so tight as to press rudely or forcibly, but so as to give an easy support to the parts.

The skin and muscles were now placed over the bone, in such a direction, that the wound appeared only as a line across the face of the stump, with the angles at each side, from which points, the ligatures were left out, as their vicinity to either angle might direct. The skin was easily secured in this posture by long slips of linen, or lint of the breadth of about two fingers, spread with cerate, or any cooling ointment. If the skin did not easily meet, strips of sticking plaster were preferred. These were applied from below upwards, across the face of the stump, and over them a soft tow-pledget and compress of linen; the whole being retained with the many-tailed bandage, and two tails placed perpendicularly, in order to retain the dressings upon the face of the stump.

Mr. Alanson censured the plan of raising the end of the stump far from the surface of the bed with pillows, as the posterior muscles were retracted by it; and he considered it best to raise the stump about half a hands breadth from the surface of the bed, by which means the muscles were put in an easy relaxed position. The many-tailed bandage Mr. Alanson found much more convenient than the woollen cap, frequently used in former times to support the dressings and he observes, that though this seems well calculated to answer that purpose, if not put on with particular care, the skin is liable to be drawn backwards from the face of the stump; nor can the wound be dressed, without first lifting up

the stump to remove the cap. (See *Alanson's Practical Obs. on Amputation*, 8vo. Lond. 1779.)

The chief peculiarity of Alanson's method of operating, namely, the mode in which he recommends the oblique division of the muscles to be performed, did not, however, meet with universal approbation, and his extensive dissection of the skin from the muscles was complained of as excessively painful. The formation of a conical wound, by following Alanson's directions, was regarded by several as impracticable. (See *Marten's Paradozieen*, B. 1. S. 88; *Loeffler, Beytrage* 1. No. 7; *Wardenburgh, Briefe eines Arztes* 2. B. p. 20; *Richter, Anfangsgr.* vol. 7; *Graefe, Normen, &c.* p. 8; *Hey, Pract. Obs.*) In my opinion, there can be no doubt of the truth of some of the criticisms made by these, and some other writers, on the impossibility of making a wound, with a regular conical cavity, by observing the directions given by Alanson; for, if the knife be carried round the member with its edge turned obliquely upwards towards the bone, it will pass spirally, and, of course, the end of the incision will be considerably higher, than the beginning. But, although Alanson probably never did himself exactly what he has stated, I am sure, that his proposition of making an oblique division of the muscles all round the member, has been the source of great improvement in amputations in general, and is what is usually aimed at by all the best modern surgeons. It is true, they do not actually perform the oblique incision all round the limb, by one stroke, or revolution of the knife round the bone, as Alanson says that he did; but, they accomplish their purpose by repeated, distinct, and suitable applications of the edge of the instrument, turned obliquely upwards towards the bone, or bones.

Among others, Mynors found fault with some of Alanson's instructions, and thought every desideratum might be more certainly attained by saving skin enough, and then cutting through the muscles. The first incision, however, he directs obliquely upwards through the integuments, while they were drawn up by an assistant, and he then cut down to the bone. (*Pract. Thoughts on Amputation*, 8vo. Birmingham. 1783.) Sprengel considers Mynors's plan merely as a revival of Celsus's method, as it had in view only the preservation of skin, and not the formation of a fleshy cushion. (*Geschichte der Chir.* B. 1. p. 426.)

Kirkland endeavoured to improve Mynors's plan, by cutting off a piece of skin at each angle of the stump, so as to keep the integuments from being thrown into folds; and, in opposition to Pott, he defended the sentiments of Bilguer concerning the successful management of desperate cases, without amputation. (*On the present State of Surgery*, p. 273, and *Thoughts on Amputation*, 8vo. Lond. 1780.)

B. Bell used to operate very much in the same way as Mynors; and, when it seemed

advantageous to make a flap, he did not disapprove of the plans suggested by Ravaton, Verduin, and Alanson. (*Syst. of Surgery*.)

An interesting paper on amputation was some years ago published by Loder; its chief purport was to defend Alanson's method, with some slight modifications. (*Chir. und Medic. Beobacht.* B. 1. p. 20. 8vo. 1794.) However, the alterations suggested by Loder, do not seem to Graefe at all adequate to the removal of the difficulties, with which the mode of cutting the flesh exactly after Alanson's directions is complicated. (*Normen für die Abl. grosserer Gliedmassen*, p. 8, 4to. Berlin 1812.)

The removal of limbs without bloodshed, proposed by Guido di Cauliaco in the 14th century, has met with modern defenders in J. Wrabetz and W. G. Plouquet. J. Wrabetz, with a ligature which was daily made tighter, took off an arm above the elbow. In the fissure, he sprinkled a styptic powder. On the fourth day, the flesh was severed down to the bone, which was sawn through. (*Geschichte eines ohne Messer abgesetzten Oberarms*. 8vo. Freyb. 1782.) Plouquet thought the plan suited to emaciated timid subjects; but not well adapted to the leg, or forearm. (*Von der unblutigen Abnehmung der Glieder*, 8vo. Tub. 1786.)

Some other modes of doing flap-amputations, and in particular, the suggestions and improvements, made by Hey, Chopart, Dupuytren, Larrey, and other modern practitioners, will be noticed in the description of the amputation of particular members. In the mean time, I shall conclude this section with mentioning the laudable attempts made at different periods, to render the patient less sensible of the agony produced by the removal of a limb. Theodoricus, as we have said, administered for this purpose opium and hemlock, and though he was imitated by many of the ancient surgeons, few moderns have deemed the practice worthy of being continued. Guido made the experiment of benumbing the parts with a tight ligature; but a machine, devised a few years ago in England, expressly for the object of stupifying the nerves of a limb previously to amputation, is perhaps not undeserving of further consideration. (See *J. Moore's Method of preventing, or diminishing Pain in several Operations of Surgery*, 8vo. Lond. 1784.) The great reason of the latter plan being given up, is, that some patients have made more complaint of the sufferings occasioned by the process of dulling the sensibility of the nerves, than of the agony of amputation itself, without any such expedient. Yet, daily experience proves, that the pressure caused on the sciatic nerve by sitting with the pelvis in a certain position, will completely numb the foot and leg, and this with such an absence of pain, that the person so affected is actually unaware of his foot being asleep, as it is termed, until he tries to walk. On the little good done by warming and oiling the cutting instruments,

a method recently much commended, (*Faust und Hunold über die Anwendung des Oehls und der Wärme*, p. 3-23, Leipzig, 1806.) I am sure it is unnecessary for me to comment.

AMPUTATION OF THE THIGH.

The thigh ought always to be amputated as low as the disease will allow, so that as little of the limb may be cut off as possible, the pain may not be greater than necessary, and the surface of the wound have less extent than would otherwise happen. (*Sabatier, Méd. Ob. p. 350. t. 3. Ed. 2.*) The patient is to be placed on a firm table, with his back properly supported by pillows, and assistants, who are also to hold his hands, and keep him from moving too much during the operation. The ankle of the sound limb is to be fastened, by means of a strong band, or garter, to the nearest leg of the table.

Here, however, through an imprudent solicitude to obtain the above advantages, let not the surgeon ever be unmindful of the great axiom in surgical operations, that all the diseased parts should be removed; but, let him be assured of the truth of what Graefe inculcates, that it is more pardonable to cut away too much, than too little. (*Normen für die Ablosung grosserer Gliedm. p. 60.*) At the same time I do not agree with some modern writers, who deem it necessary to amputate beyond the limits of every abscess and sinus, which may extend very far above a diseased joint, or compound fracture. Many of these suppurations are only like ordinary abscesses, and finally get well, after the main disease or injury is removed, as I have often seen. Were it an invariable rule to cut off a limb, above every collection of matter, sometimes five, or six inches more of the thigh would be sacrificed, than circumstances absolutely demanded, and the greater danger of a high, than a low operation, would be encountered. However, in all cases, where the bone is suspected to be unsound, or the muscles are effected with the morbid changes, peculiar to fungus hæmatodes, or other incurable diseases, the operation should be practised sufficiently high to take away all the distempered parts. In secondary amputations, where there has been much supuration in the limb, and a sinus runs up, Mr. Guthrie says, that if the sinus extend only a short way between the muscles, the membrane lining it may be dissected out; but, if the matter has lain upon the bone, this will have become diseased, and amputation should be done high enough to remove the affected part of it. (*On Gunshot Wounds*, p. 87.)

Many writers disapprove of amputating too close to the knee (*Graefe, Op. cit. p. 60*;) and Langenbeck urges one objection to it, not specified by any other author, viz. that, if the operation be done lower down than two hand-breadths above the knee, the femoral artery shrinks into the

aponeurotic sheath, which it here receives from the vastus internus and triceps, and cannot be drawn out with the forceps, so as to be separately tied, without first slitting up that sheath. Hence, he recommends cutting through the muscles at the distance above the knee already mentioned. (*Bibl. für die Chir. B. 1, p. 571, 12mo. Gott. 1806.*) But when I come to look at the breadth of two adult hands, and see how much of the limb would be sacrificed, at all events, only to save a little trouble, I cannot bring my mind to concur with Langenbeck, the remedy being worse than the evil alleged.

The next thing is the application of the tourniquet. (See *Tourniquet*.) The pad should be placed exactly over the femoral artery, in as high a situation as can be conveniently done. When the thigh is to be amputated high up, it is better to let an assistant compress the femoral artery in the groin, with any commodious instrument, furnished with a round blunt end, calculated for making direct pressure on the vessel without injuring the integuments.—Some authors indeed give a general preference to this method, whether the thigh be amputated high up, or low down, except where skilful assistants are not at hand. (*Paroisse, Opusculcs de Chir. p. 188. Brunninghausen. Erfahr. über die Amp. p. 273. Langenbeck, Bibl. Chir. p. 564.*) Were the patient, however, in a debilitated state, and unable to bear loss of blood, as there might, in this way, be some considerable bleeding, by reason of the anastomoses with the branches of the internal iliac artery, I should feel disposed to employ the tourniquet whenever circumstances would admit of its application. In amputations of the thigh, the great objection to the use of this instrument, is, that it impedes the free and immediate retraction of the loose muscles after they have been cut, the consequence of which is, that the surgeon cannot divide so high, as he otherwise could do, those deeper muscles which are more fixed and attached to the bone. Yet, in order to have the bone well covered with flesh, and no danger of a sugar-loaf stump, the latter object is one of infinite importance. Perhaps the best general rule is, to abandon the application of the tourniquet in amputations, done as high as the middle of the thigh, except where the patient is remarkably weak, so that he cannot bear the smallest loss of blood, and there is no steady intelligent assistant at hand, to whom the compression of the artery in the groin can be prudently confided. When, however, the operation is to be done much higher up, of course the employment of a tourniquet is wholly inadmissible.

Whether the right or left thigh is to be removed, it is customary for the operator to stand on the patient's right side. The great advantage of this situation seems to be, that the surgeon's left hand can be thus more conveniently, and quickly brought into use, than if he were always to stand

on the same side, as the limb he is about to amputate. This seems to be the only assignable reason for this habit: for, when the left thigh is to be amputated, it is certainly some inconvenience to have the right limb, between the operator, and the one that is to be removed. But this is found less inconvenient, than not having the left hand next the wound.

Mr. Guthrie, in speaking of amputations on the two lower thirds of the thigh, observes, that "in these cases the tourniquet should be used;" but in operations high up the thigh, he joins all other surgeons in recommending the inguinal artery to be compressed against the os pubis. (*On Gunshot Wounds*, p. 202.) The utility of slackening the tourniquet completely, however, as soon as the principal vessels are secured, a piece of advice delivered by this excellent surgeon, I presume, cannot be right on the ground, which he specifies, viz. the impediment made by the strap of the instrument to the retraction of the muscles, and the consequent difficulty in high operations of sawing the bone, *because in common practice, the bone is always sawn before any of the vessels are secured*; and loosening the tourniquet entirely, while any arterial branches still require the ligature, must generally be objectionable, if loss of blood be a disadvantage. In flap-amputations, high up the limb, indeed, where the arteries are sometimes tied, before the division of the bone, the employment of a tourniquet at all is quite out of the question.

We know that it was an opinion of the late Mr. J. Bell, that the flow of blood through a large artery could not be completely stopped by pressure; and Mr. Hey of Leeds adopted a similar notion, in consequence of seeing a case, in which the application of two tourniquets to the thigh did not restrain the hemorrhage from a fungus hæmatodes of the limb. He says; the pressure of the tourniquet does not completely obstruct the passage of blood in the arteries; it only diminishes so much of the force of the current, as to enable the vessels, in a sound state, to exert their natural contractile power so effectually as to prevent hemorrhage. (See *Hey's Pract. Ob.* p. 267, 268, Ed. 2.) Of the inaccuracy of this doctrine, no man can doubt, who sees the femoral artery with its open mouth on the face of a stump not bleeding, while the tourniquet is tight, or skilful pressure is kept up, but throwing out its blood to a great distance, the instant the pressure is discontinued. Nor, I apprehend, can any surgeon, who has amputated at the shoulder, and seen how completely pressure commands the flow of blood through the open-mouthed axillary artery, join in the sentiment of John Bell and Hey upon this particular point. Here I can speak with confidence, because I have myself amputated at the shoulder, and assisted at this operation several times, and found the statements of the preceding writers perfectly and clearly contradicted. Were any

further testimony required, I might cite that of Dr. Hennen, who mentions, among other facts, that in a shoulder joint case operated upon by Mr. Dease, the amount of blood, lost from the principal artery, was no more than the quantity contained between the point of pressure, and the point of incision through the vessels. (*Principles of Military Surgery*, p. 257, Ed. 2.) The same fact presented itself in the example, where I recently assisted Dr. Blicke, in private practice.

How then are we to explain the occasional continuance of bleeding, notwithstanding the pressure of one, or even two tourniquets? Without doubt, by the fact, that the pads of these instruments, when not duly arranged, do more harm than good, by raising the band off the vessel, and, perhaps also in Mr. Hey's example, by the additional consideration, that tumours of the fungus hæmatodes kind, include a large quantity of blood, and will bleed profusely, and for a considerable time after the main supply of blood to them is cut off. The same thing happens in the disease, called aneurism by anastomosis, as I have had several opportunities of witnessing, but in no instance more strikingly, than in one, where, some time after Mr. Hodgson had tied the radial and ulnar arteries, Mr. Lawrence divided every part of the finger, excepting the tendons and bone, and yet a considerable bleeding went on from the further side of the wound. (See *Med. Chir. Trans.* vol. 9, p. 216.)

The application of the tourniquet is generally left too much to assistants; but, as far as my judgment extends, no operator is justified in commencing his incisions, before he has examined and fully satisfied himself, that the instrument is correctly applied. Mr. Guthrie candidly tells us, that he once lost an officer, in consequence of hemorrhage during the operation, although the tourniquet was in the charge of a surgeon of ability; and the advice with which he follows this statement, is worth recollecting: "In a case of this kind, where it (the tourniquet) is found of little benefit, the surgeon should not continue twisting and turning it, whilst his patient is bleeding, but quit it altogether, and compress the artery against the pubis." This maxim, I think, cannot be too highly commended.

The shape and size of the pad of the tourniquet are deemed by surgeons matters of importance. At St. Bartholomew's, the pads employed are very firm, being composed of wood, or cork covered with leather, and rather thicker than the thumb, the upper surface being flat, and the lower, which is put against the thigh, being convex. They are about an inch and a half in length. Such pads answer extremely well, as I can affirm from the observation of some hundreds of amputations in that hospital. A common fault formerly was the employment of pads which were too large, and soft, and not judiciously shaped. As Mr.

C. Hutchinson remarks, the principal objection to a large pad is, that the band of the tourniquet is so much raised by it, that a considerable space is left on each side of it, where no compression is made on the limb, however closely the instrument may be screwed, and thus there will be a risk of hemorrhage from such vessels as happen to be in these situations. The same gentleman uses a pad, which is not thicker than a finger, and places it obliquely over the artery, so as to preclude the possibility of displacement. (*Pract. Obs. in Surgery*, p. 21-23.) Mr. Guthrie says, "the pad should be firm and rather narrow, and carefully held directly over the artery, while the ends of the bandage, in which it is contained, are pinned on the thigh. The strap of the tourniquet is then to be put round the limb, the instrument itself being directly over the pad, with the screw entirely free. The strap is then to be drawn tight, and buckled on the outside, so as to prevent its slipping, and not interfere with the screw, which is to be turned until the pressure is sufficiently strong to stop the circulation. If the screw require to be turned, for more than half its number of turns to effect this, the strap is not sufficiently tight, or the pad has not been well applied; and they must be replaced." (*On Gunshot Wounds*, p. 204.)

In two amputations at St. Bartholomew's Hospital, I saw the tourniquet break after the soft parts had been divided, and, as in one of these cases a good deal of blood was lost, because another tourniquet happened not to be in the room, and pressure on the artery in the groin was not immediately adopted, I coincide with such writers, as recommend the rule of always having two tourniquets ready. Graefe even goes so far as to advise putting both of them round the limb before the operation commences. (*Normen für die Ablösung grosserer Gliedmassen*, p. 48;) but, the frequency of a tourniquet breaking is not so great, I believe, as to demand such precaution, and the plan would be very objectionable in thigh amputations, where it is a material advantage to have plenty of room between the place of the incision and the band which goes round the limb.

An assistant, firmly grasping the thigh with both hands, is to draw upward the skin and muscles, while the surgeon, beginning with that part of the edge of the knife, which is towards the handle, makes a circular incision, as quickly as possible through the integuments down to the fascia, or, as Mr. Guthrie and Dr. Hennen recommend, even completely through it. According to Mr. Guthrie, the skin cannot be sufficiently retracted, unless the fascia be divided, which he appears to think ought rather to be drawn up with the integuments, than dissected from them. (*On Gunshot Wounds*, p. 205. Also *Hennen's Military Surgery*, p. 263.) On the contrary, Professor Langenbeck is very particular in enjoining surgeons to avoid cutting through

the fascia by the first sweep of the knife, because he finds the muscles are better held together, and can be more regularly divided, by cutting them and the fascia at the same time. (*Bibl. für die Chir.* l. 1. p. 564.) Nor does M. Roux divide the fascia by the first incision. (*Mém. sur la Réunion immédiate de la Plaie après l'Amputation circulaire*, p. 9. 8vo. Paris, 1814.) At St. Bartholomew's, the surgeons rarely, or never cut through the fascia with the integuments, but aim at carrying the knife perfectly down to it all round the limb. This at least ought to be done, without fear of doing rather more; for, as Graefe observes, if the outer layers of the muscles be here and there a little touched, this occasions less pain, than the additional strokes of the knife for dividing any portion of the skin and cellular substance, not completely cut through in the first instance. Graefe also dissents from Mynors and others, who are advocates for cutting the skin obliquely instead of perpendicularly, because he finds the thin edge of the integuments, thus separated from the subjacent cellular membrane, very apt to slough. (*Normen für die Abl. grosserer Gliedmassen*, p. 102.) In a thigh of ordinary dimensions, the first incision should be made four inches below where it is intended to saw the bone. When the thigh is bulky, the large amputation knife will be found the best. Before beginning this first cut, the arm is to be carried under the limb, till the knife reaches almost round to the side on which the operator stands. With one sweep, penetrating at least to the fascia, the knife is then to be brought round to the point, where it first touched the skin. Thus, the wound is more likely to be regularly made, than by cutting first on one side, and then on the other, while the patient is saved some degree of pain, in consequence of the uninterrupted quickness, with which the incision is made. At the same time I ought to confess, that the late Sir C. Blicke, and some other surgeons, whom I have seen operate, used to complete the circle by two strokes of the knife so well and expeditiously that their capricious attachment to this plan could hardly be found fault with.

The next object is the preservation of as much skin as will afterwards conjointly with the muscles, cut in an oblique direction, cover the end of the stump with the utmost facility. It is rather difficult to lay down any other general principles, for the guidance of the surgeon in saving integuments. I am disposed to agree with several modern writers, that the painful dissection of the skin from the muscles has been recommended and practised to a very unnecessary extent; that is to say, unnecessary, if the division of the muscles be performed in the most advantageous manner. Graefe, one of the best surgeons at Berlin, does not dissect the skin from the muscles at all in amputating the thigh, but takes care, after making the cutaneous incision, to have the integuments, and subjacent

flesh very firmly drawn up before commencing the oblique division of the muscles. This retraction he also strongly advises to be done uniformly and smoothly all round the member, lest, in dividing the muscles, any irregular projection of the skin interfere with the requisite movements of the knife. (*Normen für die Alb. grosserer Gliedmassen.* p. 103.) However, Langenbeck, another of the most skilful operators on the continent, prefers detaching the integuments from the fascia for about two finger-breadths. (*Bibl. für die Chir. b. 1. p. 567.*) as is perhaps the most common practice in the London hospitals. Brünninghausen thinks skin a better and more durable covering for the end of the bone, than muscular fibres, which after a time dwindle away, and hence he computes the quantity of integuments which ought to be saved, by the measure of the circumference and diameter of the member. Thus, when the limb is nine inches in its circumference, the diameter is about three: therefore, one inch and a half of skin on each side is to be saved. (*Erfahr. &c. über die Amp. p. 75.*) But this author cuts the muscles perpendicularly, so that he is obliged to separate much more skin from the flesh than is necessary, when the incision through the muscles is carried obliquely upward. Mr. Hay's method of calculation, which I shall presently notice, appears more adapted to ordinary practice; and he says, "the division of the posterior muscles may be begun at half an inch, and that of the anterior, at three quarters, above the place where the integuments were divided." (*Pract. Obs. in Surgery, p. 523, Ed. 2.*) With a view of preventing the necessity of dissecting the skin from the fascia, Mr. Guthrie, as already noticed, commends the plan of cutting through the fascia, together with the integuments by the first stroke of the knife, and retracting these parts at the same time, instead of detaching them from each other. If this method be found perfectly efficient, and it be not objectionable, as exposing the muscles to be cut unnecessarily. I think the reason specified against it by Langenbeck, and explained in a preceding page, not weighty enough to form a just ground for rejecting a practice, which comes with the alleged advantage of superseding the necessity for all painful dissection of the skin from the muscles. However, in secondary amputations of the thigh, if the integuments be unsound, and will not retract, Mr. Guthrie approves of their being dissected back to an equal distance all round. (*On Gunshot Wounds, p. 205—208.*) Dr. Hennen, by giving an oblique direction to all the incisions through the muscles, obviates the necessity for much dissection of the integuments, and, he says, that, in a small limb, he has repeatedly performed the operation with one sweep of the knife, cutting obliquely inwards and upwards at once to the bone. (*Principles of Military Surgery, p. 265, Ed. 2.*) This author, like Mr. Guthrie, also recommends carrying the knife through

the fascia in the first circular incision; and so does Mr. C. Hutchinson, who makes no mention of dissecting back the skin, but simply states, that the "integuments and fascia being divided by a circular incision, and retracted upwards, as high as is judged necessary, the superficial muscles should next be divided, &c." (*Pract. Obs. in Surgery, p. 23, 8vo. Lond. 1816.*) We are therefore to conclude, that he joins Graefe and others in thinking the separation of the skin from the fascia unnecessary. My own observations in practice, lead me to believe, that the dissection of the integuments from the subjacent parts used formerly to be carried to an extent beyond all moderation and necessity, and that as it is a most painful proceeding, and hurtful by forming a large loose pouch for the lodgment of matter, it ought to be abandoned by every surgeon, who follows the method of sawing the bone considerably higher, than the first cut through the superficial muscles. I am not, however, prepared to assert, that no dissection at all is generally requisite, but am rather disposed to believe the moderate adoption of it, as recommended by Mr. Hey, the most prudent. This gentleman, like Desault, (*Œuvres Chir. T. 21, p. 545.*) is an advocate for amputating with a triple incision, and for preserving such a quantity of muscular flesh and integuments, as are proportionate to the diameter of the limb. By a triple incision, he means first an incision through the integuments alone; secondly, an incision through all the muscles, made somewhat higher, than that through the integuments; and thirdly, another incision through that part of the muscular flesh, which adheres to the bone, made round that point of the bone, where the saw is to be applied. The proper distance of these incisions from each other, he says, must be determined by the thickness of the limb, upon which the operation is to be performed; making allowance for the retraction of the integuments, and of those muscles which are not adherent to the bone. Supposing the circumference of the limb to be twelve inches, where the bone is to be divided, the diameter is about four inches, and, if no retraction of the integuments were to take place, a sufficient covering of the stump would be afforded by making the first incision at the distance of two inches from the place where the bone is to be sawn, that is, at the distance of the semidiameter of the limb on each side. But, as the integuments, when in a sound state, always recede after they are divided, it is useful to make some allowance for this recession; and to make the first incision, in this case at least two inches and a half, or three inches, below the place where the bone is to be sawn. As the posterior muscles of the thigh retract a great deal in the process of healing, Mr. Hey advises their division to be begun half an inch above the place where the integuments were cut, and the anterior muscles three quarters of an inch. The integuments, says he, will

retract a little both above and below the place, where they were divided; but, the distance from that place must be computed from the mark left upon the surface of the muscles in dividing the integuments. Thus, in fact, in a common thigh amputation, Mr. Hey deemed it necessary to detach the skin from the muscles merely to the extent of half an inch at the back part of the limb, and of three quarters in front: a very different practice from the old custom of making quite a bag of integuments, and turning them back, like the upper piece of a glove is turned down, or rather as the sleeves of a coat are turned up.

In common amputations of the thigh, Roux strongly disapproves of separating the skin far from the muscles, as a circumstance highly unfavourable to the healing of the wound by adhesion; he divides only a few of the cellular bonds between the integuments and fascia; and occasionally he has imitated M. Louis in cutting through the skin, and superficial muscles together. (*Mem. sur la Reunion de la plaie après l'Amputation, &c. p. 9.*)

I believe the generality of the best modern operators are now convinced of the impropriety of dividing the muscles exactly in the manner directed by Mr. Alanson, viz. by letting the knife revolve uninterruptedly all round the bone with its edge turned obliquely upwards, towards the point where it is intended to apply the saw. It is a topic, indeed, to which I have already called the reader's attention in the foregoing columns. Langenbeck says, that he is perfectly convinced of the impossibility of forming a conical wound with one stroke of a large amputating knife, and joins Mr. Hey in approving of the triple incision. (*Bibl. für die Chir. b. 1, p. 564.*) The objections first urged by Wardenburgh against Alanson's method, are mathematically correct, inasmuch as the course of the edge of the knife, in this gentleman's method, must be spiral, and the end of the incision be considerably higher, than the beginning of it. Such must be the result of performing the division of the muscles all round the limb by one continued stroke of the knife, with its edge directed obliquely, upwards; for the idea of making the knife revolve in this manner, while its point is confined to an imaginary, regular, determinate circle on the bone, I believe is now abandoned, as not really practicable. Yet, with the exception of Desault, who confined himself to the triple incision, conducted on the principles of M. Louis, (*Œuvres Chir. T. 2, p. 547.*) few experienced surgeons refuse to acknowledge, that, in this operation, immense advantage does proceed from the oblique division of the muscles, the honour of bringing which method into practice, Mr. Alanson still unquestionably merits, however he may have erred in recommending the conical wound to be made with one sweep of the knife. Nor are there many living surgeons, who entertain a doubt of the excellence of the

principle, inculcated by M. Louis, respecting the utility of dividing the loose superficial muscles first, and then such as are deeper and adherent to the bone. In fact, a combination of this last method, with the oblique division of the muscles, not exactly by one, but several strokes of the knife, constitutes the mode of amputating at present most extensively adopted, and sometimes termed, as already mentioned, amputation by a triple incision. Thus, after the skin is cut, and as much of it retracted and saved as is deemed necessary, the operator next cuts through the loose muscles of the thigh, at the edge of the retracted skin, first those on the forepart of the limb, and then such as are situated behind. For this purpose, he makes two, or more sweeps of the knife as may be found necessary, carefully directing them obliquely upwards toward the point, where he means to saw the bone. The oblique division of the muscles does not merely enable the operator to saw the bone higher up than he could otherwise do, and leaves at the same time more muscle covering its extremity, but it is a preservation of sound undetached integuments, which assuredly form the most efficient and durable covering for the stump. I say this, without precisely coinciding with Brunninghausen, who trusting entirely to skin for covering his stumps, makes an extensive detachment of it from the muscles, and then cuts straight down to the bone. The loose muscles, actually cut through, now retract considerably, leaving those which are deeper and attached to the bone, in a condition to be cut higher up, than could have been previously done. Lastly, these are also to be divided by the edge of the knife directed obliquely upwards toward the place, where the saw is to be applied. Some operators do more than this, for after cutting down to the bone, they follow the plan of Celsus, and detach the flesh from its whole circumference upwards with a scalpel, to the extent of about another inch, in order to be enabled to saw the bone still higher up. "*Inter sanam vitalemque partem incidenda scalpello, caro usque ad os, reducenda ab eo sana caro, et circa os subsecanda est, ut eâ quoque parte aliquid ossis nudetur.*" This method, I think, deserves commendation, because it may have considerable effect in hindering a protrusion of the bone, if it does not, in conjunction with the foregoing method of operating, and judicious dressings, render this disagreeable event quite impossible. As long as I live, however, I shall never forget a poor soldier, whose thigh had been amputated in Bergen-op-Zoom, and who was brought about ten days after the operation into the military hospital at Oudenbosch under my care. Not the slightest union of any part of the wound had taken place; abscesses had formed under the fascia on every side of the stump; the loose skin was literally a large bag of purulent matter; the muscles were wasted to almost nothing, and their remains retracted,

and shrinking still further away from the extremity of the bone, which protruded at least three inches beyond the soft parts. This unfortunate man had been attacked with chronic tetanus soon after the operation, and, probably, it was to the disturbance of the stump by the effects of that disease, and to the strong and continual tendency of the muscles to retract themselves, induced by this state of the system, the deplorable state of the stump was to be attributed. He lingered nearly a fortnight in the hospital before he died, previously to which event large abscesses, communicating with the hollow of the stump, surrounded the greater part of the pelvis. As I had every reason to believe that the operation had been skilfully done, perhaps when I say that the above mode of amputating will make a protrusion of the bone impossible, it is not exactly correct, as the occurrence may sometimes originate from causes, which are quite independent of the particular way, in which the operation has been executed.

The practice of detaching the bone from the circumjacent flesh to the extent of about an inch, after the other principal incisions are completed, as advised by Celsus and Louis, I have sometimes seen done at St. Bartholomew's Hospital, and have practised myself on other occasions, with the decided advantage of letting the bone be sawn higher up, than could otherwise have been effected. Mr. Guthrie, after the incisions are carried down to the bone, even recommends dissecting back the muscles from it "for the space of two, or three inches, as the size of the limb, or other circumstances may require;" but, I should be reluctant myself to imitate the practice to this extent, though inclined to think most favourably of it within more moderate limits. If we reckon that three inches of the member lie between the first circular cut in the skin and the place, where the knife arrives at the bone, and then take away two or three inches more of the femur, it is clear that, in many examples, we should be getting very high up the limb, and, if a detachment of the muscles from the bone to the extent of two or three inches were thus made, it would at all events be of no service, unless the bone would admit of being sawn at this great distance from the termination of the oblique division of the muscles. However, if this were truly practicable (a point, which I leave for others to discuss) it would certainly be consonant to the excellent general maxim, laid down by J. L. Petit, that in amputation as much of the bone, and as little of the flesh, should be taken away as possible. (See *Traité des Mal Chir. T. 3. p. 150.*) When this final detachment of the deep muscles from the bone is adopted, particular care, as Roux observes, should be taken always to divide the thick aponeurosis, connecting the triceps to the linea aspera. (*Mem. sur la reunion de la Plaie après l'Amputation, p. 10.*)

With respect to Desault's method of amputating the thigh by a circular incision, already mentioned, he considered turning the knife obliquely upwards quite unnecessary: his plan was to cut through the muscles, layer after layer, with the precaution of retracting the first stratum before he divided the second: the latter was then cut through on a level with the flesh that had been previously divided and retracted; and so on down to the bone. This, says he, is the right way of forming a true hollow cone, of which the integuments, which were drawn up before the muscles were cut, form the base, from which are gradually continued the various layers of muscles, and the highest point of which is the bone itself. Desault owns, that this method is somewhat tedious and painful: but, in his opinion, these disadvantages are more than counterbalanced by the benefits procured for the patient. (*Œuvres Chir. de Desault par Bichat, T. 2. p. 547.*)

Having cut all the muscular fibres on every side, down to the bone, a piece of linen, somewhat broader than the diameter of the wound, should be torn at one end, along its middle part, to the extent of about eight or ten inches. This is called a retractor, and is applied by placing the exposed part of the bone in the slit, and drawing the ends of the linen upward on each side of the stump. In this manner, the retractor will obviously keep every part of the surface of the wound out of the way of the saw. Graefe thinks, that, in amputations of parts, where there is only one bone, the unslit portion of the linen should always be applied over the anterior muscles, as these ought constantly to be most evenly kept back, so that no projection of them may interfere with the action of the saw. (*Normen für die Ablosung grösserer Gliedm. p. 105.*) This is a preference, however, which may not be of great importance, though I confess, that there appears some reason in what Graefe has stated. That meritorious surgeon, J. L. Petit, whose name I always mention with pleasure, strongly commends the use of the retractor, the ends of which he drew over the anterior muscles: he says, that he has employed this simple and natural means, but, that it did not suit the taste of every body, especially of those who consider all the merit of an operation to consist in the quickness of its performance, or who think it satisfactory reasoning to say, this is not their way. (*Traité des Mal. Chir. T. 3, p. 152.*) I have seen the saw do so much mischief, in consequence of the operator neglecting to use the retractor, that my conscience obliges me to censure such surgeons as neglect to defend the soft parts by this simple contrivance. There are some who have rejected the use of the retractor, because they have seen it get under the teeth of the saw, and obstruct the action of the instrument; but, this very circumstance adduced against the retractor, is, when considered, the strongest one that could possi-

bly be brought forward in its favour, as the surface of the wound itself, and particularly the edges of the skin, would, in all probability, suffer the same fate as the linen. by getting under the teeth of the saw, if no retractor were employed, in attempting to saw the bone high up, as closely as possible to the soft parts. I think no one can urge any, but the most frivolous objections to the use of the retractor; and I know, that many who have been with myself eye-witnesses of the mischief frequently done by the saw in amputations, are deeply impressed with an aversion to the neglect of this bandage. I have often seen the soft parts skillfully divided, and I have, in these same instances, seen the operators, directly afterwards, lose all the praise, which every one was ready to bestow, by their actually sawing through one half of the ends of the muscles together with the bone. Men who have had fortitude not to utter a sigh, nor to let a groan be heard, in the previous sufferings, have now had their involuntary cries extorted from them by unnecessary, unjustifiable torture. But, besides defending the surface of the stump from the teeth of the saw, the retractor will undoubtedly enable the operator to saw the bone higher up, than he could otherwise do.

Another proceeding, which seems fit for reprobation, and which, indeed, Mr. Alanson very properly condemned, is the practice of scraping up the periosteum with the knife, as far as the muscles will allow. Nothing seems more probable, than that this may be the cause of the exfoliations which occasionally happen after amputations. At all events, it is a superfluous, useless measure, as a sharp saw, such as ought to be employed, will never be impeded by so slender a membrane as the periosteum. All that the operator ought to do, is to take care to cut completely down to the bone, all round its circumference. Thus a circular division of the periosteum will be made, and upon this precise situation the saw should be placed. This is the method which was approved of by J. L. Petit. (*Traité des Mal. Chir.* T. 3, p. 159.) It is what I have always done and recommended; yet, it must be confessed, that differences of opinion prevail about the necessity, and modes of dividing the periosteum. Graefe, in common with several others, entertains considerable apprehension of the effects of the periosteum being torn and lacerated by the saw, exfoliations of the bone and abscesses up to the joint being possible consequences of the rude separation and inflammation of this membrane. Hence, he is an advocate for making a circular cut through at the place where the saw is to be applied, and then scraping away all below this point in the direction downwards. (*Normen für die Abl. grosserer Gliedm.* p. 165, and 105.) Perhaps, no very great objection may lie against this mode, which is not uncommonly followed, though I have some doubts of its real utility, a scarcely seems practicable, in the midst of the ooz-

ing of blood, to hit with the saw the precise line at which the remains of the periosteum terminate; and, in confirmation of the safety of Petit's practice, Mr. Guthrie's experience may be adduced, who says, "I have often sawn through the bone, without previously touching the periosteum, and the stumps have been as soon healed, and with as little inconvenience, as any others." (*On Gun-shot Wounds*, p. 88.) A very modern author, impressed, like many others, with the fear of tearing the periosteum with the saw, differs from them in thinking it best to scrape the periosteum upwards, by which means, he says, that at least half an inch of this membrane, and a proportionate quantity of muscular fibres, may be preserved for covering the end of the bone, inasmuch as the muscular fibres, adherent to the periosteum, will remain connected with it; an advantage, which this author deems very important while the edges of the bone are sharp. In amputation below the knee, he considers the method highly useful, as the sharp edge of the tibia may be not merely covered with skin, but periosteum, and the cellular membrane connected with it. Since his adoption of this practice, he assures us, that he has not for a very long time seen any exfoliation of the tibia, and never any protrusion of the bone of a stump. (*Brunninghausen Erfahr.* &c. *über die Amp.* p. 65, 66. 8vo. *Bamb.* 1818. Such are the sentiments of a gentleman who has published a valuable tract on amputation, as well as some other works of deserved reputation. His opinion is unquestionably the reverse of what is mostly prevalent in England; and I think his practice liable to the objection, that the disadvantages of scraping the bone at all, and denuding it, may exceed the benefit supposed to proceed from afterwards bringing down the detached membrane over its sharp margin, even admitting this to be always practicable.

But, in no part of the operation of amputation do operators in general display more awkwardness, than in sawing the bone, though, if we except directing the saw against the flesh, the faults are here less pernicious in their consequences than the errors already noticed. At the time of sawing the bone, much depends upon the assistant who holds the limb. If he elevate the lower portion of the thigh bone too much, the saw becomes so pinched that it cannot work. On the other hand, if he allow the weight of the leg to operate too much, the thigh bone breaks before it is nearly sawn through, and its extremity is splintered. It is one of the most common remarks of such persons, as are in the habit of frequently seeing amputations, that the part of these operations, which a plain carpenter would do well, foils the skill of a consummate surgeon, and few operators acquit themselves well in the management of the saw. Many of them begin the action of this instrument, by moving it in a direction contrary to the inclination of its teeth.

Many, seemingly through confusion, endeavour to shorten this part of the operation, by making short, very rapid, and most convulsive strokes, with the saw. Almost all operators fall into the error of bearing too heavily on the instrument. That operator will saw best, who makes the first stroke of the saw, by applying its heel to the bone, and drawing the instrument across the part, towards himself, so as to make a slight groove in the bone, which serves very materially to steady the future operations of the instrument; and who makes long, regular sweeps with the saw, rather slowly than quickly, rather lightly than heavily. But, there is often a fault in the construction of the saw itself, which impedes its action, quite independently of any fault on the part of the surgeon. I allude to not having the edge of the instrument a little broader, than its blade. When the saw is well made, the teeth always make plenty of space for the movement of the rest of the instrument. The instrument, as Mr. Guthrie recommends, should cut with both edges, backwards and forwards, which expedites the operation, and (what is of more consequence) helps to prevent splintering when the bone is nearly divided, because the division can be finished by the backward motions, which are the most gentle. (*On Gunshot Wounds*, p. 89.)

Graefe commends the plan of oiling the saw, for the purpose of facilitating its action; (*Normen für die Abl. grösserer Gliedmassen*, p. 65.) and though the method is innocent enough, the best operators in this metropolis do not consider it sufficiently important for adoption.

If the bone should happen to break before the sawing is finished, the sharp pointed, projecting spiculæ, thus occasioned, must be removed by means of a strong, cutting sort of forceps, termed *bone nippers*. The perpendicular division of the bone leaves a sharp edge at the extremity of its circumference: it is not the common practice to take any measures for the removal of such sharpness; yet, Graefe recommends filing it away, (*Op. cit.* p. 66.) and Mr. C. Hutchinson makes it an invariable rule, whether there be any occasion to use the bone nippers or not, "to take off the asperities, and scrape, or endeavour somewhat to round, the sharp cut edge of the bone, with a strong blunt scalpel, in order to prevent the soft parts from being injured when brought over the end of the bone in forming the stump." (*Pract. Obs. in Surgery*, p. 24.) Though I have not followed this practice, or rather the part of it, which relates to cutting off the edge of the bone, nor seen it adopted in London in amputation of the thigh, I know of no objection to it, unless it be on the score of its inutilty, and the delay, which it occasions. All projecting points of bone, it is the ordinary custom to remove.

After the removal of the limb, the femoral artery is to be immediately taken hold of with a pair of forceps, and tied with a

firm round small ligature, the best being that kind which is recommended and used by my friend Mr. Lawrence, (See *Ligature*) care being taken to leave the accompanying branches of the anterior crural nerve out of the noose. None of the surrounding flesh ought to be tied, though the ligature should undoubtedly be placed round the artery, just where this vessel emerges from its lateral connexions. Mr. Hey has been accustomed to tie the femoral artery twice, leaving a small space between the ligatures, and this method has been constantly used in the Leeds Infirmary. Some reasons against this plan will be found in the article (*Hæmorrhage*.) The other arteries are usually taken up with a tenaculum. After tying as many vessels as require it, one half of each ligature is to be cut off, near the knot on the surface of the stump. One portion is quite sufficient for withdrawing the ligature when this becomes loose, and the other being only an extraneous body, and productive of irritation and suppuration, should never be allowed to remain.

My friend, Dr. Hennen, in his excellent publication, ascribes the improvement of removing one half of the ligature, to Mr. James Veitch, a naval surgeon, who, in April, 1806, published some valuable precepts relative to the mode of tying the arteries in amputation. (See *Edinb. Med. and Surgical Journal*, Vol. 2. p. 176.) But highly as I approve of the tenor of the anonymous paper here referred to, it is impossible for me to suppose Mr. Veitch could be the first, who suggested such improvement. When I went as an apprentice to St. Bartholomew's hospital, in 1797, no surgeon of that hospital ever followed any other mode, and the practice was then so far from being new there, that gentlemen, who were at the hospital seven years before myself, saw one half of each ligature regularly cut off the first time they went into the operating theatre of that munificent institution. The use of very broad ligatures, and the inclusion of a considerable quantity of flesh in the noose together with the vessel, were also practices quite exploded at St. Bartholomew's at the very beginning of my apprenticeship. Mr. Veitch, however, seems to merit the honour of having been perhaps the first to set the example of *tying every vessel, the femoral, as well as the smaller arteries, with a single silk thread*, taking care to include, as far as possible, nothing but the artery; and when this had been done, he took off one half of each ligature, as near as possible to the knot, "so that the foreign matter introduced was a mere trifle, compared with what I had been accustomed to see." (*Edinb. Med. and Surg. Journ.* Vol. 2. p. 178.) The use of a *single silk thread* was then the part of these improvements, probably originating with Mr. Veitch, though the principles which led to this innovation, were unquestionably first established by Dr. Jones.

Mr. Alanson directs the ends of the ligatures to be left hanging out at the two ex-

tremities of the wound, according as their nearness may point out as best. But when a ligature is situated in the centre of the wound, it is best to bring it out between the strips of adhesive plaster, at the nearest part of the surface; otherwise its running across one half the wound to get at either angle, would create a great deal of unnecessary irritation and suppuration. The advantages of this method of placing the ends of the ligatures were well explained by Mr. Veitch, but, his practice, like the innovation of cutting off the half of each ligature, as been common in the London hospitals, and at St. Bartholomew's in particular, many years earlier. I presume, than the case referred to by this gentleman, since it has been familiarly adopted in those institutions ever since 1797, as I can testify from my own personal observation. These remarks are offered, without the slightest intention of detracting from the merits of the above-mentioned paper, which is replete with valuable advice; nor am I influenced by any design of throwing honour on the memory or character of any other individual at the expense of Mr. Veitch, being at this time unacquainted with the exact periods, when either this improvement, or that of removing the half of each ligature commenced. M. Roux is one of the few remaining modern surgeons, who declare their preference to the method of bringing out all the ligatures at the lower angle of the wound, the benefit of having them brought out thus down, so as to keep up a drain for any pus that may form, being in his opinion greater, than that of arranging them at the points of the wound nearest to them. *Mém. sur la Réunion de la Plaie après l'Amp. p. 12.*)

As Dr. Hennen observes, the reducing the immoderate size of ligatures; the separating the threads of which they were composed, and placing them at convenient points along the face of the stump, or wound; and the actual removal of one half of each ligature, were amendments very slowly made; but, (says he,) "an improvement, which appears to me of great consequence, was the last of introduction, and is now the slowest of adoption, although the artery once secured, and the value of adhesion duly acknowledged, it is the most obvious of all. I allude to the plan of removing the ends of the ligature altogether, and thus leaving to an extensive wound the greatest possible chance of immediate union." The first printed mention of this practice, as far as Dr. Hennen's investigations have discovered, was in a letter written by Mr. Haire, dated Southminster, Essex, Nov. 1786. "The ligatures," says this gentleman, "sometimes became troublesome and retarded the cure. An intimate friend of mine, a surgeon of great abilities, proposed to cut the ends of them off close to the knot, and thus leave them to themselves. By following this plan, we have seen stumps healed in the course of ten days. The short ligature thus left in, commonly made its

way out by a small opening in a short time, without any trouble, or the patient being sensible of pain." (See *Lond. Med. Journ. Vol. 7.*) Certainly, considering the thickness of the ligatures in use at the above period, this testimony of the success of the method, as Dr. Hennen remarks, is very satisfactory. (*Principles of Military Surgery, p. 181, Ed. 2.*) In a letter received by me from Mr. Dunn, surgeon at Scarborough, and dated June 3, 1819, he tells me, "My predecessor Mr. J. Wilson, the late partner of Mr. Travis, amputated a limb in 1792, or 93, and cut off the ligatures close to the arteries, and no trouble ensued. He did this from the recommendation of Dr. Balcombe, of York, who had seen the method practised on the continent." In September, 1813, Dr. Hennen, who was serving with the army in Spain, began the adoption of this plan, which, he expected, would not only prove useful in promoting immediate union, but in obviating any accidental violence to the ligatures, and the wrong interference of the younger dressers in trying to pull them away. Between September and January, thirty-four cases were treated in this way, without any inconvenience following, or the small particles of silk left behind giving rise to any apparent irritation. Dr. Hennen also presented to Sir J. McGrigor, some of the small circles of silk, a part of which had come away with the dressings, while others had floated out on opening the little pustules, which formed over the face of the stump at the points, where the arteries had been tied. Some few of the ligatures never made their appearance, and the patients complained of no uneasiness whatever. Convinced of the utility of the method, Dr. Hennen, afterwards published an account of it. (*See Lond. Med. Repository, Vol. 3. p. 177. and Vol. 5. p. 221.*) This gentleman subsequently found that Dr. Maxwell of Dumfries had adopted the plan as far back as 1798; and Dr. Ferguson, who was at Stockholm during the peace of Amiens, saw it also then followed by some of the surgeons of that city, without any ill effects. (*Hennen's Military Surgery, p. 175.—178, Ed. 2.*) In July, 1814, Mr. Lawrence communicated to the Medical and Chirurgical Society of London, some cases and observations highly in favour of the practice; and the particularity, which he lays much stress upon, is using for the purpose minute firm ligatures composed of what is called dentist's silk. (*See Med. Chir. Trans. Vol. 6. p. 156.*) And, in a paper of later date, he says, his further experience had confirmed the usefulness of the method, "that this plan, by diminishing irritation and inflammation, and simplifying the process of dressing, very materially promotes the comfort of the patient, and the convenience of the surgeon, while it has not produced ill consequences, or any unpleasant effect, in the cases which have come under his own observation." According to Mr. Lawrence, the small knots of silk generally separate early, and come away with the dis-

charge; that where the integuments have united by the first intention, the ligatures often come out rather later, with very trifling suppuration, and that, in some instances, they remain quietly in the part. (*Obs. cit. Vol. 8, p. 490.*)

After the battle of Waterloo, it was tried in many cases both by Mr. Collier, and myself, though our ligatures were certainly not so minute and eligible as those employed by my friend Mr. Lawrence. As I joined the army in the field after nine days, and was therefore obliged to leave my patients at Brussels to the care of others, I lost the opportunity of witnessing the effects of this method. But, from Mr. Collier, I afterwards learned, that the new plan and the common one appeared in his judgment to answer about equally well; which report, considering that we did not use the smallest ligatures, must be regarded as favourable. When the plan is tried, single strong threads and silks, or rather the kind of ligature, which will be described in another place, (See *Ligature*.) should be employed; for, otherwise the knots would be large, and likely to create suppuration and future trouble. The practice has likewise been tried by M. Delpech at Montpellier; but, it is not explained, whether he used single threads, or silks, or whether any inconveniences resulted from the method. (See *Relation d'un Voyage fait à Londres en 1814, ou Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise* by P. J. Roux, 8vo. 1815.) Yet candour requires me to state, that the method is not universally adopted, and that one well informed writer, as I shall hereafter notice, (See *Hæmorrhage*.) has recited a case and some experiments, which are unfavourable to the practice. (*Cross, in Lond. Med. Repository, Vol. 7, p. 355.*) Mr. Guthrie has also in two or three instances seen some ill looking abscesses arise from the presence of the bits of ligature, though he approves of the plan where the wound will not unite by the first intention, which, however, can rarely be known beforehand. (*On Gun-shot Wounds, p. 941.*)

My friend, Mr. Downing, deputy inspector of military hospitals, formerly saw this practice tried; but he informs me, it did not answer, as repeated suppurations and discharges of bits of ligatures followed from time to time, after the patients conceived themselves cured. But, probably, the large thick ligatures in common use some years ago, were here employed, and if this were the case, the experiments cannot be compared to that made with a minute ligature of dentist's silk.

Sometimes, the sawn surface of the bone itself bleeds rather profusely. When this happens, it is an excellent plan, which I have often seen my late master, Mr. Ramsden, and others, adopt with the greatest success, to hold a compress of lint over the end of the bone, during the time requisite for securing the rest of the vessels. At the end of this period, the compress may gene-

rally be taken away, the bleeding from the bone having entirely ceased. As Monro remarks, the surgeon ought not to content himself with tying only such vessels, as he observes throwing out blood, while the patient is faint with pain: he should endeavour to rouse him from that faintish state by a cordial; and then wiping off the coagulated blood with a sponge, wet in warm water, he should examine narrowly all the surface of the stump; for, otherwise, he may expect to be obliged by a fresh hæmorrhage to undo all the dressings. (*On Amputation of the Larger Extremities, p. 475, Monro's Works.*)

When there is merely an oozing from small vessels, Bromfield's advice to loosen the tourniquet completely, is highly proper, as this measure, and washing the stump with a little cold water, will put an entire stop to such bleeding, without any occasion for more ligatures. A good deal of blood is sometimes lost from the mouths of the larger veins, and where they bleed much in debilitated subjects, I think Dr. Hennen is right in recommending them to be tied. (*On Military Surgery, p. 264.*) There is no necessity for doing so, however, in ordinary cases; nor should I be disposed to imitate Mr. Hey, who, in consequence of having seen a few instances of bleeding from the femoral vein, generally enclosed that vessel in the ligature along with the artery. (*Practical Obs. in Surgery, p. 530. Ed. 2.*) This method, however, was sanctioned by Desault, who says, that if the vein be left open, and the bandage at the upper part of the limb be too tight, the flood regurgitates downwards, and hæmorrhage takes place, as this surgeon assures us, he has often seen. When the vein and artery lie close together, as often happens, one branch of the forceps is to be introduced into the artery, and the other into the vein, which being done, the two vessels are to be drawn out together, and included in one ligature, but, if they are not so near together, they must be tied separately. (*Euvres Chir. de Desault par Bichat, T. 2, p. 550. 8vo. Paris, 1801.*) At St. Bartholomew's, it is not the usual practice to tie the femoral vein, though it has been occasionally done; and, except in particular cases, I consider the custom wrong, because a ligature on a large vein sometimes excites a dangerous and fatal inflammation within the vessel, while the intervention of the vein between the one side of the circle of the ligature and the artery, must rather tend to hinder the thread from operating in the most desirable manner upon the latter vessel.

The wound is now to be evenly closed with strips of sticking plaster, so that the edges of the cut skin may form only a straight line across the face of the stump. This was the mode commended by Alanson, and is what is preferred by the generality of the best surgeons in this country. It is also advised by Græfe. (*Normen für die Abl. grösserer Gliedm. p. 106. Guthrie on Gunshot Wounds, p. 208.*) Over these

plasters, and the ends of the ligatures, it is best to place some pieces of lint, spread with the unguentum spermatis ceti, in order to keep such lint from sticking, which becomes an exceedingly troublesome circumstance, when the dressings are to be removed. I am decidedly averse to the general plan of loading the stump with a large mass of plasters, pledgets, compresses, flannels, &c.; and I see no reason, why the strips of adhesive plaster, and a pledget of simple ointment, should not suffice, when supported by two cross bandages, and a common linen roller, applied spirally round the limb, from above downward. The first turn of the roller, indeed, should be fixed round the pelvis, while the lower circles secure the cross bandages, often called the Malta-cross, over the end of the stump. It is also an excellent method to leave some little interspaces between the plasters, and in summer to keep the linen bandages constantly wet with cold water. In this way any discharge will readily escape, and the parts, being kept cool, will be less disposed to hemorrhage and inflammation.

I am completely of opinion with Mr. Alanson, that the elastic woollen cap, commonly placed over all the bandages and dressings, if not put on with a great deal of care, has a tendency to push the skin backward from the extremities of the stump, and as it must also heat the part, its employment ought apparently to be discontinued.

If possible, the dressings should never be removed before the fourth day, not reckoning the one on which the amputation is performed. Monro set down the fifth, sixth, or seventh day, as generally soon enough for this purpose. He allows, however, that, if the smell of the wound should become offensive, the outer dressings may be removed sooner. Even when the dressings are to be taken away, it will frequently be found useful not to remove one strip of plaster; but the stump must be made clean, and any discharge washed away. These and other valuable precepts, derived from the eminent Dr. A. Monro senior, are worthy their great source, and the correctness of them promises to be acknowledged for ever.

The manner of renewing the dressings of stumps, is indeed a very important business, which should never be intrusted to mere novices; for in taking off the straps of sticking plaster, if great care be not taken, the slight and newly formed adhesions may be torn asunder. Thus, as Mr. A. C. Hutchinson has remarked, if the strap be pulled off by holding one end of it at nearly a right angle with the adhering part, the flap will be raised up with it, and thus a separation of the newly united parts will be produced. "My plan (says he) is to reflect the raised end of the strap close down upon the adhering part, and to bring it gently forward with one hand, while the removing part of the strap is followed by two fingers of the other placed upon the skin. &c.; and when one end is detached from its ad-

hesion, as far as the line of incision on the face of the stump, in like manner the other end is brought down and wholly removed. (*Pract. Obs.* p. 46.)

In order to facilitate the removal of the plasters, and save the patient a great deal of pain, I have always followed the plan of letting warmish water drop over them from a sponge for a few minutes previously to the attempt to remove them. In the early part of the treatment, it is also a valuable rule never to have every strap of plaster off at once, so as to leave the flesh quite unsupported. Some skill and care are also invariably necessary, in order to avoid pulling away the ligatures at the same time with the other dressings.

At the end of five or six days, the surgeon may begin to try, in a very gentle manner, whether any of the ligatures are loose; observing rather to twist, than suddenly pull them directly outward. However, he should not use the smallest force, nor persist if the trial create pain. One would hardly try, whether the ligature on the main artery were loose, before the eighth or ninth day. If minute ligatures made of dentists silk be employed, and both their ends cut off close to the knot, of course, this delicate business of trying to get rid of the irritation of those foreign bodies is entirely superseded.

Though, in the above account, I have directed the edges of the wound, after the amputation of the thigh, to be brought together in such a way, that the wound shall appear as a line across the face of the stump, yet there are instances in which the bone seems most easily and conveniently covered, by making the line of the wound in a perpendicular direction.

Mr. B. Bell, indeed, generally approved of it, as affording a ready outlet for matter; it is likewise directed by Mr. C. Bell, (*Op. Surgery*, Vol. 1.) by Roux (*Mém. sur la Réunion immédiate de la Plaie après l'Amp.* p. 11;) and by Dr. Hennen (*On Military Surgery*, p. 165. Ed. 2.)

On the other hand, Mr. C. Hutchinson objects to it, because it seems to him, that when a stump, thus put up, is laid on a pillow, the pressure tends to separate and open the lower part of the wound. (*Pract. Obs. on Surgery*, p. 37.)

It is curious to remark, however, that the thing which leads this gentleman to disapprove of the plan, is one which would be urged in its favour by Roux, and some other surgeons, who actually take the precaution of never closing the lower angle of the wound, in order that whatever discharge occurs may find a ready outlet. (*Mém. cit.* p. 14.)

Mr. Alanson objected to this method, asserting that the cicatrix afterwards became situated immediately over the end of the bone, the pressure of which was very likely to make the part ulcerate. However, in St. Bartholomew's Hospital, a thigh was sometime ago amputated by Sir L. Harvey, and the edges of the stump were brought

together in the perpendicular direction; yet, according to all accounts, a better stump could not have been made. In a case, in which I assisted Mr. Ramsden at Christ's Hospital, when an attempt was made to put up the wound in the common manner, the bone seemed to make considerable pressure against the skin, which did not happen when the line of the wound was made in the other direction, which of course was immediately adopted. Mr. Hey has noticed this subject as follows: the integuments and muscles may be brought into contact by pressing either the anterior and posterior parts, or the sides of the thigh, together. The former method, by the gradual retraction of the posterior muscles, causes the integuments of the anterior part of the stump to cover more completely the extremity of the bone. The latter method causes the integuments and muscles to meet each other the more readily, and, therefore, is to be preferred when the quantity of soft parts preserved is somewhat deficient. (*Practical Observations on Surgery*, p. 533. Edit. 2.)

From the observations of another modern writer, who disapproves of making the line of the stump perpendicular, the difficulty of covering the end of the bone sometimes arises from not duly relaxing the posterior muscles of the thigh, and therefore he condemns laying the stump on pillows, which are too high. (*A. C. Hutchinson Pract. Obs.* p. 41.)

The plan of bringing the edges of the wound together, after amputation, so that they may unite by the first intention, has received, for many years past, the universal approbation of British surgeons. It is the general practice in the treatment of all incised wounds. It may be said to be the pride of English surgery; for, in nothing does she display more convincingly her superiority. Baron Larrey, however, in cases of amputation, disapproves of the attempt to unite the wound by the first intention, and merely brings forwards its edges somewhat towards each other with a piece of linen, which covers the whole of the wound, and has small holes cut in it for the passage of the discharge. (*Mém. de Chir. Mil. T. 3*, p. 379.) This piece of linen is supported with a moderately tight roller.

M. Roux, on his arrival in this country, wondered to see British surgeons so prejudiced in favour of union by the first intention, as to adopt it after all amputations. "*C'est pareillement abuser de la réunion immédiate que d'appliquer en toute circonstance à la plaie qui résulte de l'amputation des membres. J'entends parler de l'amputation dans la continuité des membres et plus particulièrement encore de l'amputation circulaire.*" (P. 128. *Parallèle de la Chirurgie Anglaise avec la Chirurgie Française*, 8vo. Paris, 1815.) M. Roux, however, has curiously omitted to explain in his book, what are the advantages of not bringing the edges of the wound together, and why he calls prejudice the partiality to a method, the superior efficacy of which is continually de-

monstrated in every hospital of London. He does not indeed presume to condemn the practice altogether; on the contrary, he allows it to be proper in certain cases; yet he contends that it ought to be confined within particular limits. (P. 130. See, also, *Mém. et Obs. sur la Réunion immédiate de la Plaie après l'Amputation*, &c. 8vo. Paris, 1814.)

In this tract, which is well drawn up, Roux proves most convincingly the benefits of union by the first intention, after amputation of the thigh by the circular incision; but, strangely enough, his prejudices hinder him from advising the practice to be extended to other amputations. He does not positively condemn it in the arm, though he thinks the method less necessary, because amputation there is less dangerous than in the thigh, &c. (P. 45.) To such futile reasoning is this author reduced by the unsoundness of his doctrine. He also deems the attempt at union by the first intention counterindicated, where limbs are amputated for injuries, which violently contuse and crush the parts (P. 48,) and where the limb is much wasted. (P. 50.) In the latter condition, however, he thinks Desault's flap amputation may be done, and an effort made to heal the wound by adhesion. In one case, he did this with success. (P. 51.)

Richerand informs us, that Dubois at Paris follows the plan with a success equal to that of the London surgeons. For some years past, he has himself also constantly endeavoured to accomplish union by the first intention, after all the amputations which he has had occasion to practise, and he succeeds at least in three out of four. "The method is preferable (says he) to the old one, in whatever point of view it is considered. This union is more expeditious, a few days being sufficient for its completion. A woman, whose thigh I took off in 1810, was very well in a week, &c. Besides the advantage of a quick cure, and such quickness is especially of great importance, where the patient has been much reduced, so that he would hardly be able to bear a long suppuration, union by the first intention has the recommendation of saving the patient from a great deal of pain, the flap of integuments, with which the bleeding surface of the stump is covered, being much less irritating to the flesh, than the softest charpie would be, &c. Three years have elapsed since the publication of the third edition of this book. During this interval, I have performed more than a hundred and fifty amputations, and the utility of immediate union has been more and more proved to me." (*Nosographie Chirurg.* p. 475, 477. Edit. 4.)

But, notwithstanding these and other encomiums on the practice, Richerand, like other French surgeons, is not an advocate for it in certain cases, as, for instance, limbs shattered by gunshot wounds, or affected with hospital gangrene. Here, he maintains, that it hardly ever succeeds. (P. 478.) But, though it be true that ampu-

tations after gunshot-wounds do not generally heal so well, as many other cases, it cannot be denied that they do sometimes unite more or less by the first intention, and why should not the chance be taken? It is productive of no danger; there is nothing better to be tried; and, if it fail, what is the harm? Why, the wound will then heal by suppuration, and the granulating process, just as soon, as if the hollow of the stump had been filled with charpie, or left open; it will in fact heal in a way, which is less advantageous, than union by the first intention, but which is the best which can now happen.

From what has been said, it appears, that the practice of healing the wound by the first intention after amputation is less general in France, than it is in England; a circumstance which may perhaps be explained by the fact of its being much newer to the French than to us. Every improvement must encounter for a time the opposition of prejudice; but, one so important as that which we are considering, must at length prevail, and meet with universal adoption. Our extraordinary partiality to union by the first intention arises from a conviction of its superior efficacy, and is a decisive proof of the goodness of English surgery in respect to wounds. The observations of Roux and Richerand tend to prove, that they are not altogether unaware of its advantages, and they therefore recommend it for certain cases; but, their backwardness to extend it to all amputations, without exception, is little in favour of the parallel, which they are so fond of advancing between French and English surgery.

However, that stumps may fall into a state, in which the pressure of all plasters and bandages whatever should be most carefully avoided, and emollient poultices used, is a truth of which every surgeon of experience must be fully convinced. This happens whenever the parts are affected with considerable tension, inflammation, and swelling, or painful acute abscesses. There is also no utility in keeping the edges of the wound very closely compressed together, when all chance of adhesion is past, and the parts must heal by the granulating process. My friend, Mr. Guthrie, after amputations, performed from necessity in parts not in a healthy state, as in most secondary amputations after compound fractures of the thigh, does not insist upon the edges of the wound being brought into close contact by sticking plaster, compress, and bandage. In these cases, he also recommends the bone to be sawn an inch shorter than usual, or than would be necessary under other circumstances, in order to prevent its protrusion, and the ligatures to be cut off close to the knots, so as to lessen irritation. The integuments and muscles are to be brought forward, and retained so by a moderately tight roller, but not laid down against the bone. Some fine lint, smeared with cerate or oil, is to be put between the edges of the wound; and a piece of linen and a Malta-cross over it, supported by a few light

turns of the roller. "In some cases (says Mr. Guthrie,) I have put one, and even two straps of plaster over the stump to keep the edges approximated, without being in contact; and, where the parts are but little diseased, this may be attempted; but, if the stump becomes uneasy, they should be cut, and a poultice applied. When only a part of the stump has appeared to slough, I have found the spiritus camphoræ alone, or diluted with a watery solution of opium, applied with the lint, very useful." (*On Gunshot Wounds*, p. 104.)

The reasons, which induced Mr. Guthrie to incline to the plan of not bringing together the edges of the wound, in cases of this description, must be learned by reference to his own valuable work. His cases and arguments are entitled to serious consideration; and though they, as well as the observations of Roux, (*Mém. sur la Reunion immédiate de la Plaie après l'Amputation*, Svo. Paris, 1814,) leave me unconvinced of the usefulness of not bringing the edges of the wound together, immediately after the amputation of bad compound fractures, there are some of his observations respecting the injurious effects of too much pressure in certain conditions of the stump, perfectly agreeing with my own sentiments. At present, I have never seen any case of amputation, in which I should not have thought the surgeon wrong, had he not brought the sides of the wound together directly after the operation, so as to afford the chance of union by the first intention.

HEMORRHAGE AFTER AMPUTATION.

Bleeding, after the operation, is of two kinds, in regard to the time, when it occurs. The first takes place within twenty-four hours after the operation. Hence, an assistant should always be left with the patient, with directions carefully and repeatedly to look at the stump, and if any bleeding should arise, to apply the tourniquet, until further aid be obtained. In case no assistance can be spared for this purpose, as must frequently happen in country practice, the tourniquet should always be left loosely round the limb, and the nurse, or patient, himself, directed to turn the screw of the instrument, in order to tighten it in case of need. A slack tourniquet left round the limb, after amputation, cannot do harm, and its not having been ready in this way, has cost many patients their lives, as I have known instances of.

This kind of hemorrhage has often been known to arise from the pressure of a tight bandage round the stump. As Monro observes, the circular turns of the bandage, when tight, must stop the return of blood in the cutaneous veins, and thus by making a greater resistance to the blood in the arteries, which anastomose with them, occasion the contracting power of the heart and arteries to dilate, and force more blood into their other branches; but, these being cut in the amputation, will pour out their blood, and so hemorrhage is brought on. Making

much pressure round the stump is highly deserving of reprobation; and whenever there is an universal oozing of blood, I would recommend the operator to be sure, that the circulation in the superficial veins is not impeded by the tightness of any bandage or tourniquet.

If the bleeding should not be from an artery of consequence, the application of linen, dipped in the cold water, will sometimes check it, and the disagreeable necessity for removing the dressings and opening the wound, may thus be avoided.

But, it often happens, that the wound must be opened, and the bleeding vessel tied. This is a very painful proceeding to the patient, and when the dressings have been applied some hours, so that the stump has had time to inflame, nothing can exceed the suffering to which the patient is now subjected. Here we see the prudence of being particularly careful at first to tie every suspicious vessel.

The second sort of hemorrhage, after amputation, arises from ulceration of the large arteries, and may occur a month after the operation, when the ligatures are all away, and the patient seems nearly well.

Two such cases are related by Mr. Bromfield (Vol. I. p. 307.) This kind of bleeding is less common than formerly, now the plan of covering the stump with sound skin is adopted. When the bleeding vessel is large, there is no chance of putting the patient out of danger, except by cutting down to the vessel, and tying it. The trunk of the vessel, however, may sometimes be more conveniently tied, than the bleeding branch itself.

Mr. Hey makes mention of a particular sort of hemorrhage, after the operation: "I have seen (says he,) a few instances of the integuments becoming so contracted after the operation, as to compress the veins just above the extremity of the stump, and bring on after some hours a copious hemorrhage. When it has appeared clear to me, that the hemorrhage was venous, I have made a division of the integuments, on one side of the thigh, sufficient to remove the stricture, and this method has immediately suppressed the hemorrhage." (P. 530. *Edit. 2.*)

I have never yet met with a case, in which a hemorrhage was unequivocally produced by a contraction of the integuments. Dr. Hennen says, that he has seen only one example, and it was successfully treated by loosening the bandage, and moistening the dressings with cold water. (*On Military Surgery*, p. 264. *Ed. 2.*) Doubts may therefore be entertained, whether the cause was the pressure of the integuments, or of the roller, on the veins.

In Mr. Guthrie's truly practical work, there are some excellent remarks on the hemorrhages, which, in the irritable and sloughing state of a stump, frequently take place from the small branches, or from the main trunks of the arteries, in consequence of ulceration. It is (says he) not always

easy to discover the bleeding vessel, or when discovered, to secure it on the face of the stump; for, as the ulcerative process has not ceased, and the end of the artery, which is to be secured, is not sound, no healthy action takes place. The ligature very soon cuts its way through, or is thrown off, and the hemorrhage returns; or, some other branch is opened, and another ligature is required, which is equally uncertain; and under this succession of ligatures and hemorrhages, the patient dies. Here, cutting down to the principal artery, in preference to another amputation, has often succeeded; but, under certain circumstances, it fails, and amputation becomes ultimately necessary. At the same time, it is allowed, that this operation may also fail. On the whole, Mr. Guthrie professes himself to be an advocate in most cases for tying the artery in the first instance; and if this proceeding should not answer, he would then amputate. However, the practice of taking up the artery in these cases, he thinks, should not be adopted indiscriminately, the doctrines of aneurism not being here applicable, because there is a wounded vessel, with an external opening. "In the thigh, the operation is less certain, than in the arm, and especially, if it is not the main artery that bleeds; for, the branch, from which the hemorrhage proceeds may come from the profunda, and tying the artery in the groin on such opinion would be doing a serious operation, and one, which probably would not succeed; for, the anastomosing branches would restore the circulation in the stump in a short time, and again establish the bleeding. If it is the femoral artery that bleeds, and the ligature is applied high, it is very liable to a return of hemorrhage. To obviate these difficulties, the part, from which the bleeding comes should be well studied, and the shortest distance from the stump carefully noted, at which compression on the artery commands the bleeding; and, at this spot, the ligature should be applied, provided it is not within the sphere of the inflammation of the stump." (*On Gun-shot Wounds*, p. 105-106.) Thus far the advice seems to me correct and valuable; but, where the hemorrhage could be restrained by taking up the artery in the groin, though not lower down, I doubt the propriety of preferring amputation to this other far less severe operation, admitting that the efficiency of a ligature above the profunda, has been proved in the manner judiciously recommended by Mr. Guthrie, viz. by means of pressure.

The following is the council offered by Mr. Hey in a case of this nature.

"When we are under the necessity of amputating a limb, that has suffered great contusion, though the operation is performed upon a part apparently sound, the wound sometimes becomes sloughy and ill conditioned. No good granulations arise to cover the extremities of the arteries; but the ligatures cut through these vessels, or becoming loose, cease to make a sufficient pressure

upon them, and hence repeated hemorrhages ensue. This is a dangerous state for a patient; for, if the vessels are taken up afresh with the needle, the hemorrhage will now and then return in the course of two, or three days. In such cases, the application of dry sponge, cut transversely, as directed by Mr. White (*Cases in Surgery*), has been found singularly useful, and has saved the life of the patient. But, a constant pressure must be kept upon the pieces of sponge, by the fingers of a succession of assistants, till granulations begin to arise upon the stump, and the prospect of future hemorrhage disappears. This method is of the greatest importance after amputation on the thigh, or leg, where the great vessels are deeply seated. In the arm, above the elbow, where the vessels are more superficial, the great artery may be taken up, with a portion of muscular flesh, above the surface of the stump, by making first an incision through the integuments. My colleague, Mr. Logan, has done this twice within the last year, with complete success, when repeated ligatures, applied in the usual way, had failed.

"In the morbid sloughy state of the stump, abovementioned, the application of lint, soaked in a liquid, composed of equal quantities of lemon-juice and rectified spirit of wine, has been found very advantageous, and has caused it to put on soon a healthy aspect." (P. 536, 537, *edit.* 2.)

ON PROTRUSION OF THE BONE.

It is clearly proved by the observations of M. Louis, that this disagreeable consequence may be generally prevented by taking care to divide the loose muscles first, and (after their complete retraction, which will be favoured by no band, nor tourniquet being applied round the limb,) by observing to divide with a bistoury the muscles which are adherent to the bone; for instance, the crural muscle, and the point of adhesion of the vasti and triceps at the posterior spine of the femur. By this method, the bone may be very easily sawn three finger-breadths higher than it can be, if no attention be paid to beginning with the division of the loose muscles, and concluding with that of such as are more attached to the bone.

The protrusion of the bones will never take place, so long as they are immediately encompassed with the fleshy substance of the muscles: this proposition is incontestable. The state of the skin, whether longer or shorter, conduces nothing to this protrusion; nor will the inconvenience be prevented by drawing the skin upward, and preserving as much of it as possible. (*See Mém. sur la Saillie de l'Os après l'amputation in Mém. de l'Acad. de Chirurgie, tom. 5. p. 273, edit. in 12mo.*)

As Mr. Guthrie has correctly observed, a protrusion of the bone, after sloughing of the stump, or other accidental circumstances, will sometimes happen, without any

fault on the part of the operator; but, he thinks, it may almost always be prevented by attention to the following rules: 1. To leave the integuments attached to the muscles, instead of turning them back. 2. When the muscles are cut through in a slanting direction, upwards and inwards, or even directly downwards, to separate them from the bone, so that it may appear at the bottom of the cone as a depressed point; 3. To cut the bone short, and to keep the thigh constantly bandaged from the trunk during the cure, so as to prevent the retraction of the muscles. If, says Mr. Guthrie, a surgeon find directly after the operation, that the bone cannot be well covered, he should immediately saw off as much more of it, as will reduce it to its proper length. The error may be remedied at this moment with very little inconvenience in comparison with what must afterwards be encountered, if the opportunity be neglected. (*On Gun-shot Wounds, p. 109.*) For some very useful directions how to bandage and support the soft parts with adhesive plasters, with the view of counteracting the tendency of the bone to protrude, I refer to some observations by Mr. Wright. (*See Bromfield's Chir. Cases, &c. Vol. 1, p. 177.*)

Having explained, that the surest way of preventing the evil is to save a sufficiency of muscle, especially of that muscular substance which is naturally most near and adherent to the bone, we shall next speak of the mode of relief.

When the end of the thigh-bone protrudes, it of course hinders cicatrization, and becomes itself affected with necrosis. By the process of exfoliation, the dead portion of bone is sometimes thrown off, and a cure follows. But, in general, this desirable change is extremely tedious, and uncertain as to the result, because it frequently happens, that after the piece of bone has separated, the rest yet projects too much, and the stump still continues too conical to heal firmly enough to be capable of bearing the pressure of a wooden leg. When, however, the end of the bone forms only a slight projection, and the stump is not too conical, it is always best to leave it to nature to throw off the redundant exfoliating portion. In the opposite circumstances, the operation of removing all such part of it as cannot be covered by the integuments, is the best thing which can be attempted, and, if well executed, will effect a cure.

This second operation is exceedingly unpleasant to the surgeon, because patients are apt to suspect, with reason, that the first was not properly managed. Let me therefore repeat, that the surest way of avoiding the evil, is to cut the deep muscles rather higher than the superficial ones, as inculcated by M. Louis, by which means the bone will certainly lie within the level of the surface of the divided flesh. The advice delivered by my friend, Mr. Guthrie, I also consider valuable.

The second performance of amputation is a still more severe and unpleasant opera-

tion; yet, as Dr. Hennen has explained, it sometimes becomes necessary from osteosarcoma, extensive necrosis, abscesses of the medulla, unsuspected fissure, phagedena, or great protrusion of bone, with an extensively diseased periosteum, where the powers of nature are inadequate to the cure. "If the general health is not impaired, and the flesh does not peel off from the bone, as if it were boiled, the efforts of nature may be trusted to, aided by proper bandaging, and, in some cases, by the employment of the saw; but, when restless nights, intense pain, flushings, and irregular bowels, with great tumefaction and hardness of the stump, take place, indicating approaching hectic, and there is evidence of an irregular action of the parts, osseous matter becoming deposited, and forming a distinct tumour around the stump, our best plan will be to operate again near the trunk." (*Principles of Military Surgery*, p. 226, Ed. 2.) The following works are particularly recommended by this gentleman for information on diseases of the bones of stumps: *Bonn, Thesaurus Ossium Morborum*, Amst. 1788; *Weidmann de Necrosi Ossium*, Francof. 1798; *Macdonald, De Necrosi ac Callo*, Edinb. 1799; the abovementioned *Essays of M. Louis*; *Levéillé sur les Mal. des Os après l'Amputation*, *Mém. de la Société d'Emulation*, T. 1. p. 148; *Von Hoorn De iis, quæ in partibus membri, præsertim osseis amputatione vulneratis, notanda sunt*; Lugd. 1803. *Roux, de la resection des Os Malades*, Paris 1812; and *Mém. de Physiologie, &c. par Scarpa et Lévéillé*, Paris, 1804.

SPASMS OF THE STUMP.

Spasmodic contractions of the muscles of the stump is another very afflicting occurrence. Such spasms put the patient to the greatest agony, tend to cause a protrusion of the bone, or sugar-loaf stump, and, in some cases, increase, affect the whole body, and ultimately occasion death. But, this unfortunate affection, which was rather frequent after amputations performed in the ancient manner, is infinitely less so, after the modern improved plans of operating, tying the vessels, and dressing the wound. When, however, it does occur, the stump must be kept from starting, by fastening it to the pillow and bedding, on which it lies, the flesh is to be properly supported with a bandage, applied from the pelvis downwards, and opium, and camphorated medicines are to be liberally exhibited. (*Encyclopédie Méthodique, Partie Chirurgicale*, Tom. 1. p. 93. *Latta's Surgery*, Vol. III. &c.)

FLAP-AMPUTATION OF THE THIGH.

Although I concur with the majority of surgeons in regarding the operation by a circular incision the most eligible under ordinary circumstances, no doubt can exist about the preference, which should be given to amputating with a flap, in particular examples. This method, I believe, has the important advantage of being least exposed

to the danger of a protrusion of the bone, and hence, I think, it may be advisable, whenever any reasons exist in the state of the parts, or the constitution, for apprehending that disagreeable occurrence. An experienced modern military surgeon informs us, that, in the first years of his practice, he performed several amputations by the double incision, strictly according to the precepts of Sabatier, Desault, Pelletan, and Pott, but had the mortification to have three cases, in which the bone protruded, though the greatest circumspection was used in the operation and after-treatment. Hence, he was induced to make trial of the flap-amputation, and although he imitates O'Halloran in not attempting to bring the flaps close together for the first eight days, he reports that the stump is generally healed in from twenty to thirty days, and exfoliations rarely happen, on account of the bone being so well covered. In short, he says, that this method is to be preferred to all others. (*J. B. Paroisse Opusc. de Chir.* p. 185-203, Paris 1806.)

A description of Desault's, or rather Vermale's mode of operating, being given in the 4th Ed. of the First Lines of the Practice of Surgery, Vol. 2, I need not here repeat it, nor say, by how many respectable names the practice is sanctioned. Of late, the operation has been done by my friend Mr. Vincent in St. Bartholomew's Hospital, who showed me a few weeks ago a capital stump, which he had made in this manner, and which had healed with great expedition.

By Mr. Guthrie, the flap-operation is considered preferable to the circular incision at the upper part of the thigh, "as it permits the head of the bone to be removed, if found necessary, allows it to be examined and cut shorter with greater ease, and makes a much better covering afterwards." (*On Gunshot Wounds*, p. 200.)

In military surgery, flap-amputation of the thigh is often advantageous, because all the flesh on one side of the limb is frequently torn away, or left in so terribly a mangled state, as to be unfit for making a covering for the end of the bone. Here a flap, sufficient to cover the whole face of the stump, should be saved from the sound flesh on the other side of the limb. When the surgeon chooses the flap-amputation, not from necessity, as under these last circumstances, and the flesh is sound all round the member, the best way is to save a flap on each side of the limb, by making two semi-circular cuts, the convexities of which extend in a parallel manner forwards, and the terminations of which meet at the upper and lower surfaces of the limb. The skin is not to be at all dissected from the muscles, which are to be obliquely divided as high as the base of the flap on each side. However, though this is the best plan, particular cases may require a flap to be made from the anterior, or even the posterior side of the thigh. The latter method should never be followed, but from necessity.

(See *Hey's Pract. Obs. in Surgery*, p. 531, Ed. 2.)

According to Mr. Guthrie, the difference between the flap-operation, at the upper part of the thigh, and that at the hip, consists in its being done lower down, and in the flaps being saved more immediately from the external and internal sides of the thigh, the inner flap being the largest, in order to prevent the inconvenience, which might arise from the external one being tightly stretched over the end of the bone. For the same reason, Mr. Guthrie also recommends the bone to be sawn off close to the lesser trochanter, even when the nature of the injury would allow of its being left an inch longer. (*On Gunshot Wounds*, p. 200.)

Flap-amputation of the thigh, after the manner of Vermale, is now preferred to the common mode by Klein, one of the best operating surgeons in Germany. Of seven cases, in which he adopted this method, the greater number were healed in ten days, and the rest in three weeks; and this success determined him in future always to practise it. After this mode, he finds there is no danger of the muscles retracting themselves, and leaving the end of the bone protruding, even though the patient be transported from one place to another. With respect to the occasional difficulty of taking up the obliquely cut vessels, Klein admits this objection, but thinks that it equally applies to Alanson's method. He lays great stress on the utility of giving due support to the flaps with compresses and a roller. (*See Practische Ansichten der bedeutendsten chirurgischen Operationen*, p. 35—38, 4to. Stuttgart, 1816.)

In one instance, where a ball had broken the upper third of the femur, and mortification had spread so far towards the great trochanter and buttock, that it was impossible to operate, except by the flap-operation, or by taking the head of the bone out of the joint, Klein made a broad flap six inches long at the inner and upper part of the thigh, and then he cut the soft parts straight across just below the great trochanter, so as to make this wound meet the termination of the incision, by which the inner flap was formed. This patient got perfectly well in three weeks; (*Op. cit.* p. 39.) and so did another very similar case operated upon by the same gentleman. (p. 43. Where the bleeding is considerable, the femoral artery and profunda should be tied previously to sawing the bone; but, if the vessels are well commanded by the pressure, the sawing ought to be first completed.

AMPUTATION BELOW THE KNEE.

In treating of amputation of the thigh, I have remarked, that as much of the limb as possible should be preserved. The longer it is after the operation, the stronger and more useful will it be found. But when the leg is to be amputated, authors have set it down, as almost an invariable rule, that the

operation is to be performed a little way below the knee, even though the disease, for which the limb is removed, may be situated in the foot, or ankle, and would allow the operation to be done much further down. The common practice is to make the incision through the integuments, just low enough to enable the operator to saw the bones, about four inches below the lowest part of the patella. This degree of lowness is usually deemed necessary, in order not to deprive the stump of that power of motion, which arises from the flexor tendons of the leg continuing undivided. It is alleged also, as a reason for this mode of proceeding, that it is quite sufficient to preserve a few inches of the leg, in order to afford the body a proper surface of support, in walking with a wooden leg, whereas if a larger portion were saved, the superfluous part would be a great inconvenience both in walking, and sitting down, without being of the smallest utility, in any respect whatever. However, as I shall presently notice, experience proves, that, where according to these maxims, an injury, or disease would dictate the performance of amputation above the knee, the practice of amputating below this joint, but much higher than is generally sanctioned, may be followed with advantage.

The tourniquet should be applied to the femoral artery, about two-thirds of the way down the thigh, just before the vessel perforates the tendon of the triceps muscle. This place is much more convenient than the ham, where it is very difficult to compress the vessel against the bone. The patient is to be placed upon a firm table, as in the amputation of the thigh, and the leg being properly held by one assistant, while the integuments are drawn upward by another, the surgeon, with one quick stroke of the knife, is to make a circular incision through the integuments all round the limb. Some recommend the operator to stand on the inside of the leg, in order that he may be able to saw both bones at once. No reflections could ever make me perceive, that any real advantage ought strictly to be imputed to this plan. Many suppose this method diminishes the chance of the fibula being splintered, this bone being completely divided rather sooner than the tibia. But splintering the bones generally arises from the assistant depressing the limb too much, or else not supporting it enough. If the assistant were to be guilty of this mismanagement, it would be difficult to explain, why, the tibia should not be splintered instead of the fibula, when a certain thickness of it had been sawn through. At the same time, it must be admitted, that if the surgeon prefer standing on the inside of the limb, there is no objection to it at the time of using the saw; but, before this period, in amputating the right leg, there is great convenience in having the left hand next to the wound, as is the case, when the surgeon stands on the outside of the right limb. Hence I have seen many hospital surgeons,

in amputating the right leg, cut the soft parts, while they stood on the outside of the limb, and having done this part of the operation, they proceeded to the other side of the member for the purpose of applying the saw. I have only to repeat, that, I do not think any particular reason exists against sawing the two bones together, yet, in such manner, as to let the fibula be divided entirely through first; and, the advantage of fixing this bone against the tibia by the pressure of the hands of the assistants, while the surgeon is sawing it, is another circumstance, which influences a great many writers to commend the latter plan. Graefe, who, as already mentioned, prefers the true flap-operation, does not think it advisable for the surgeon to stand on the inside of the limb in his method of operating, because when the knife is introduced through the muscles of the calf, its point would be apt to go between the two bones. (*Normen für die Abl. grösserer Gliedm. p. 130.*) The following are the precepts, given by him respecting the sawing of the bones. They should, he says, be divided as high as possible; and, during this part of the operation, the fibula is to be firmly pressed by the assistant against the tibia, above and below the wound, so as not to be shaken too much in consequence of the weakness of its upper articular connexion. Graefe then directs the surgeon, as he stands on the outside of the limb, to apply the saw, as high as possible, close to the periosteum, with the handle downwards, and to saw both the bones together, until a groove deep enough for the guidance of the saw is made in each of them. The foot is now to be turned very much inwards, and the fibula completely divided, the handle of the saw being depressed as far as practicable. The foot is then to be inclined outwards, and the tibia cut through, the saw, with its handle elevated, being placed in the furrow already prepared for it. By beginning with making a groove in both bones, we are sure, says Graefe, of sawing them through exactly at the same height. The plan of beginning the division of the bones with the handle of the saw depressed, however, must certainly be inconvenient.

A circular cut having been made through the integuments, about two inches below the place where it is intended to saw the bones, the next object is to preserve skin enough to cover the front of the tibia, and the part of the stump, corresponding to the situation of the tibialis anticus, extensor longus pollicis pedis, and other muscles, between the tibia and fibula, and those covering the latter bone. Throughout this extent, there are no bulky muscles which can be made very serviceable in covering the end of the stump, and consequently the operator must take care to preserve sufficient skin in this situation, by dissecting it from the parts beneath, and turning it up.

On the back part of the leg, on the contrary, the skin should never be uselessly detached to a great extent from the large gastrocnemius muscle, which, with the soleus,

will here form a sufficient mass for covering the stump. However, the experience which I had in the army, taught me the truth of a remark made by Graefe, that, in forming the posterior flap of muscle, it is a matter of the highest importance to let the integuments be somewhat longer than it; for, otherwise, when it is turned forward, as it must be for the purpose of covering the ends of the bones, its front edge will be left uncovered by integuments, which being the outermost describe a greater circumference than the deeper muscular flap. (*Normen für die Abl. grösserer Gliedm. p. 131.*) I was fully convinced of the truth of this observation, by two amputations which were done by myself, one in the neighbourhood of Antwerp, in 1814, and the other at Brussels, the day after the battle of Waterloo. Yet Graefe, who performs the flap-amputation, strictly so called, (that is to say, the operation in which a flap of skin, corresponding in shape to the flap of muscle, is preserved) does not himself detach the skin from the muscles of the calf at all, but, at the time of making the incision in that situation, directs one assistant to pull up the integuments, while another bends the foot as much as possible, which manœuvres have the effect of letting the muscles be cut rather shorter than the skin. Unfortunately, however, in many cases, the very nature of the disease, or injury, for which the operation is performed, would not admit of these proceedings. Nor in a very muscular limb, would they be likely to suffice, as Graefe himself confesses, since, in such cases, he recommends the use of a knife bent laterally, for the purpose of excavating, as it were, as the incision is made, the thick muscular flap. (*Op. cit. p. 134.*) In the common method, with the circular incision, I am disposed to think it best, therefore, to let a small quantity of skin be detached and saved at the back part of the leg, so that there may be a certainty of having enough to cover well the extremity of the divided muscles of the calf. As soon as the skin has been separated in front, and on the outside of the leg, the surgeon is to detach the skin from the calf for about an inch, and having reflected or drawn this preserved portion out of the way, he is to place the edge of the knife close to the edge of the retracted or reflected skin at the back of the limb, and cut obliquely upwards through the muscles of the calf, from the inner edge of the tibia quite across the fibula, supposing the operator to be on the outside of the right leg, and that it is this member, which is undergoing removal. In performing this last incision, as M. Louis well observes, it is essential to incline the edge of the knife obliquely upwards. In this manner the skin will be longer than the muscles, and the cure will be considerably accelerated. (*Mém. de l'Acad. de Chirurgie, tom. 5. edit. in 12mo.*)

In the leg, the necessity of dissecting the skin from the subjacent parts, is acknowledged to be greater than in the thigh; thus,

Mr. Guthrie says, "as the attachment of the skin to the bone will not readily allow of its retraction, it must be dissected back all round, and separated from the fascia, the division of which in the first incision would avail nothing, from its strong attachment to the parts beneath." (*On Gunshot Wounds*, p. 220.) In dissecting the skin, however, a much greater detachment of it should be made at the front and outer part of the limb, than at the opposite points, as already explained.

The flap formed by the integuments, and muscles of the calf, is then to be held back by one of the assistants, while the surgeon completes the division of the rest of the muscles, together with that of the interosseous ligament, by means of the calling, a kind of long, narrow, double-edged knife.

In amputating below the knee, very particular care must be taken to cut every fasciculus of muscular fibres, before using the saw. Every part, except the bones, being divided, the soft parts are next to be protected from the teeth of the saw by a linen retractor, made with two slits to receive the two bones, care being taken to let the unsplit part be applied to the muscles of the calf, as particularly advised by Graefe. (*Op. cit.* p. 136.)

In the leg, there are only three principal arteries, requiring ligatures, viz. the anterior and posterior tibial, and the peroneal or fibular arteries. In addition to these, however, there are sometimes large muscular branches, which require to be taken up. The anterior tibial artery will be found in front of the interosseous membrane, and between the extremities of the bones; the fibular artery behind the fibula; and the posterior tibial, situated more inwardly than the last among the first of the soleus, near the tibia. (*C. Bell, Oper. Surgery*, vol. 1. p. 385.)

When the soft parts have been cut in the preceding way, the bones sawn, and the arteries tied, the wound is to be closed by bringing the flap of skin over the front and external part of the stump, so as to meet the flap composed of the gastrocnemius, soleus, and integuments on the opposite side. This should be done without letting any tight strap of plaster press the skin against the sharp edge of the tibia, a serious and hurtful practice, which has often occasioned ulceration and sloughing of the integuments, and protrusion and necrosis of the bone. It is this danger which leads Mr. Guthrie to prefer closing the wound vertically, or nearly so, and applying the adhesive straps from side to side. (*On Gunshot Wounds*, p. 221.) I think, however, the above mode of operating almost necessarily requires the wound to be closed, so as to form a line, extending in a direction from the tibia to the fibula. But, where a great deal of skin is saved all round the limb, and the muscles of the calf are not chiefly calculated upon for covering the bones, the perpendicular line of the wound will answer very well.

Many surgeons, however, operate differently. They first make the circular incision through the skin, two inches below where they mean to saw the bones. They next detach the skin from the muscles and bones equally all round the limb to the extent of about a couple of inches. The integuments are then turned up, and a division of the muscles made all round down to the bones, on a level with a line where the detachment of the skin has terminated. The parts between the bones are afterwards cut through, &c. The hemorrhage having been stopped, the integuments are drawn down over the stump. Here, I think, the wound might be closed so as to let the cicatrix be perpendicular; yet Richerand recommends it to be united from before backward, because (says he) the greatest diameter of the stump is from without inward. (*Nosographie Chirurg. t. 4. p. 485—486. edit. 4.*)

In the army, the practice has sometimes been adopted of sawing off the sharp upper ridge of the tibia; but I can offer no exact judgment on the merits of the innovation, which is making only slow progress. It has been done a few times at St. Bartholomew's, and I should have no objection to giving it a fair trial, especially as it has the sanction of Mr. Guthrie, who says, that, in thin persons, where the spine of the tibia is very sharp, this part should be removed with the saw. (p. 222.)

Occasionally, surgeons have also removed the small remnant of the fibula, and such was sometimes the practice of Larrey, when he amputated nearer the knee than common. (*Mém. de Chir. Mil. T. 3. p. 389.*)

Whether the above plan of amputating the leg so high up, when the foot or ankle is the part diseased or injured, be on the whole most advantageous, I cannot presume to determine. There are certainly many clever men who condemn the practice, and though I see it pursued by the best surgeons in this metropolis, we may safely assert, that the matter requires further consideration. If it were a decided point, that the common custom of bending the knee, for the sake of bearing the weight of the body on its anterior part, were the only one admissible, after amputation of the leg, there could be no doubt of the propriety of performing the operation a little way below the knee, in preference to any other situation. But, since there have been numerous instances of persons walking very securely with machines, which allow them to make use of the knee, and are more pleasing to the eye, on account of their perfect resemblance to a natural limb; and since also, the operation at the lower part of the leg is more easy of performance, and safer, than when done high up; some very eminent surgeons have thought that it ought always to be done near the ankle, when possible, instead of near the knee.

Mr. White of Manchester, in a paper dated 1769 (*Med. Obs. and Inq. vol. 4.*) informs us, that he took the hint to amputate a little

above the ankle, from seeing a case, in which this had been done by a simple incision, with such success, that the patient could walk extremely well, though with a machine that was very badly constructed. After this, Mr. White began to operate above the ankle with the double incision: and he invented a machine much better calculated for the patient to walk upon.

In 1773, Mr. Bromfield published his *Chirurgical Cases and Observations*, wherein he mentions his having begun about the year 1740 to amputate above the ankle, in a case of gangrene of this part of the leg. The patient walked so well, with the aid of a very simple machine, both along a level surface, and in going up and down stairs, that it was difficult to perceive he had lost his foot. Mr. Bromfield was persuaded, however, to give up this practice, until he learned that, in 1764, a Mr. Wright had thrice amputated in this way with success, when he again had recourse to it, without the least unpleasant consequences. (See *Chir. Cases and Obs. vol. 1. p. 189, &c.*)

The advantage of amputating a little below the knee is, that pressure in walking with a wooden leg is entirely confined to the front of the limb, and the cicatrix itself is not subjected to irritation. After amputating at the ankle, the pressure in walking operates directly on the cicatrix; but if the mechanical contrivances for walking are now brought to such perfection, that this pressure does no harm, the operation, perhaps, ought not to be entirely abandoned. According to Sabatier; however, the plan has been extensively tried in France, and not found to answer, the stump being incapable of bearing pressure, and not continuing healed. (*Médecine Opératoire, T. 3. p. 377. edit. 2.*) Baron Larrey also speaks of it as an objectionable operation, not merely because some patients, as for instance, soldiers, have not the means of providing themselves with artificial legs, of the above description, but because it is almost always followed by bad symptoms, owing to the small quantity of cellular substance and flesh, and the thickness of the bone at this part of the leg, whereby cicatrization is impeded. A nervous irritation is more apt to be produced by this, than the common mode of operating, and the suppuration, which is always sanious, takes place with difficulty. "I have (says Larrey,) seen many amputations done at this part, but nearly all the patients died of nervous fever, or tetanus." (*Mém. de Chir. Mil. t. 3. p. 394.*)

In the foregoing columns, I have given some account of the flap-amputation of the leg, as done by Lowdham, Verduin, Garengeot, Vermale, and others, and, in particular, the practice of O'Halloran has been touched upon, whose chief peculiarity, viz. that of not laying down the flap until ten or twelve days had elapsed, was unquestionably his greatest error, though the idea may have been admired and followed by a few speculators in modern times. (See

Paroisse, Opusc. de Chir. p. 196, &c. Paris, 1806.) This last author, who is a general approver of flap-amputations, leaves the stump unclosed for some days after the removal of the limb; but what surprises me is, to hear, that, in one of the finest hospitals in this metropolis, three or four trials have been made, in the course of the last year, of a modification of this absurd practice, after amputation by the circular incision. Instead of bringing the sides of the wound together, the stumps were only partially closed, and kept for a day or two covered with wet linen. The last patient whom I heard of as having been treated in this manner, died a few days after the operation; and it gives me pleasure to hear, that all further intention of subjecting more patients to the experiment, in the hospital alluded to, is given up.

In flap-amputations below the knee, Alanson and Lucas conjectured, that the cure might be rendered more safe, easy, and expeditious, by applying the flap, with the view of uniting it by the first intention.

The following case explains Mr. Alanson's flap-operation. The disease was in the left leg, the patient, therefore, lay on his right side, upon a table of convenient height, so as to turn the part to be first cut fully into view. The intended line where the knife was to pass in forming the flap, had been previously marked out with ink. A longitudinal incision was made with a common scalpel, about the middle of the side of the leg; first on the outside, then on the inside, and across the tendo Achillis: hence, the intended flap was formed, first by incisions through the skin and adipose membrane, and then completed by pushing a catling through the muscular parts in the upper incised point, and afterwards carrying it out below, in the direction of the line already mentioned. The flap was thick, containing the whole substance of the tendo Achillis. The usual double incision was made; the retractor applied to defend the soft parts; and the bone divided, as high as possible with the saw.

The flap was placed in contact with the naked stump, and retained there, at first, by three superficial stitches, between which adhesive plasters were used. Notwithstanding the patient caught an infectious fever a few days afterwards, the stump healed in three weeks, except half an inch at the inner angle, where the principal vent had been. In another week, the wound was reduced to a spongy substance, about the size of a split-pea. This, being touched with caustic, healed in a few days. The man was soon able to use an artificial leg, with which he walked remarkably well. He went several voyages to sea, and did his business with great activity. He bore the pressure of the machine totally upon the end of the stump, and was not troubled with the least excoriation or soreness.

In the next instance, in which Mr. Alan-

son operated, he formed the flap by pushing a double-edged knife through the leg, and passing it downwards and then outwards, in a line, first marked out for the direction of the knife. In this way, the flap was more quickly made. (*Alanson on Amputation.*)

The leg should be completely extended during the operation; and kept in that posture till the wound is perfectly healed.

We shall next notice Mr. Hey's method. This gentleman is satisfied, that very near the ankle is not the most proper place for this kind of amputation.

Some cases occurring, in which, from a scrophulous habit, the wound at the stump would not heal completely, nor remain healed, Mr. Hey determined to try whether amputation, in a more muscular part, would not secure a complete healing, and give the patient an opportunity of resting his knee on the common wooden leg, or using a socket, as he might find most convenient. Mr. Hey now prefers this method, and has reduced it to certain measures.

It had been customary, at the Leeds Infirmary, to make the length of the flap equal to one-third of the circumference of the leg. This was determined by the eye of the operator, who usually pushed the catling through the leg, near the posterior part of the fibula. Mr. Hey, finding the flap was not always of the proper breadth, began to determine this by measure, and now operates as follows: to ascertain the place where the bones are to be sawn, together with the length and breadth of the flap, he draws upon the limb five lines, three circular, and two longitudinal ones. He first measures the length of the leg from the highest part of the tibia to the middle of the inferior protuberance of the fibula. At the mid-point, between the knee and ankle, he makes the first or highest circular mark upon the leg. Here the bones are to be sawn. Here Mr. Hey also measures the circumference of the leg, and thence determines the length and breadth of the flap, each of which is to be equal to one-third of the circumference. In measuring the circumference of the limb, Mr. Hey employs a piece of marked tape, or riband, and places one end of it on the front edge of the tibia. Supposing the circumference to be twelve inches, he makes a dot in the circular mark on each side of the leg, four inches from the anterior edge of the tibia. These dots must, of course, be four inches apart behind. From each of these dots, Mr. Hey draws a straight line downwards, four inches in length, and parallel to the front edge of the tibia. These lines show the direction which the catling is to take in making the flap. At the termination of these lines, Mr. Hey makes a second mark round the limb, to show the place where the flap is to end. Lastly, a third circular mark is to be made, an inch below the upper one, first made for the purpose of directing the circular cut through the integuments, in front of the limb. The catling,

for making the flap, should be longer than those commonly employed in amputations. Mr. Hey uses one which is seven inches long in the blade, and blunt at the back, to avoid making any longitudinal wound of the arteries, which is very difficult to close with a ligature; and, for the same reason, he pushes the catling through the leg a little below the place where such muscles are to be divided, as are not included in the flap. The limb being nearly horizontal, and the fibula upward, he pushes the catling through the leg, where the dot was made, and carries it downward along the longitudinal mark, till it approaches the lowest circular mark, a little below which the instrument is brought out. The flap being held back, Mr. Hey divides the integuments on the front of the limb along the course of the second circular mark. The muscles not included in the flap, are then divided a little below the place where the bones are to be sawn. No great quantity of these muscles can be saved, nor is it necessary, as the flap contains a sufficient portion of the gastrocnemius and soleus muscles, to make a cushion for the ends of the bones. After sawing the bones, Mr. Hey advises a little of the end of the tendon of the gastrocnemius to be cut off, as it is apt to project beyond the skin, when the flap is put down; and he recommends the large crural nerve, when found on the inner surface of the flap, to be dissected out, lest it should suffer compression.

As strips of adhesive plaster cause great pressure on the end of the stump, Mr. Hey prefers using sutures for keeping the flap applied; small strips of court-plaster being put between the ligatures. The sutures may be cut out on the eighth or ninth day, and the flap supported by plasters.

Mr. C. Bell describes another sort of flap-amputation. The operation is not to be done so low, as there will not be a sufficiency of muscle to cover the end of the bones. An oblique cut is to be made, with the large amputating knife, upward, through the skin of the back part of the leg. The assistant is to draw up the skin, and the knife is to be again applied to the upper margin of the wound, and carried obliquely upward till it reaches the bones. The knife, without being withdrawn, is next to be carried, in a circular direction, over the tibia and fascia, covering the tibialis anticus, until it meets the angle of the first incision on the outside of the limb. The surgeon is then to pierce the interosseous membrane, &c. The sawing being completed, and the arteries secured, the flap is to be laid down, and the integuments of the two sides of the wound will be found to meet. (*Operative Surgery*, vol. 1.) Langenbeck disapproves of the plan of pushing the knife through the calf of the leg, as practised by Alanson, Hey, Graefe, &c. because an inexperienced surgeon may run the point between the two bones, and in this way the wound is never made evenly. His manner of forming the flap is very similar to Mr. C.

Bell's, except that he makes first three cuts in the integuments, two longitudinal and one transverse, by which the shape of the flap of skin is determined. (*Bibl. fur dei Chir. B. 1. p. 571.*)

The regular flap-amputation of the leg, I mean that operation in which the circular incision is abandoned, and a semi-circular flap both of skin and muscle preserved, is often considered more painful than the common method, because it cannot be done with equal celerity. Yet when we come to see what respectable names are recorded in its favour, how soon the stump generally heals, how well the ends of the bones are covered, and how all dissection of the integuments from the fascia is avoided in this mode of operating, at least as far as the flap extends, the method must be allowed to possess weighty recommendations. Indeed in its present improved state, and with the peculiar fitness of such a stump for adhesion, this operation, I think, is again rather rising in the estimation of the profession. In 1816, Klein had performed flap-amputation of the leg, about twenty times. If the flap should happen to be made too large, he particularly dwells on the propriety of removing part of it at once; and, when it is too short, he enjoins carrying the incision a little further upwards without delay. He confesses that the plan is attended with some little trouble in securing the interosseous arteries, which are apt to retract considerably, but, such has been the success of his practice, that out of twenty cases, seventeen got well, and most of them very soon, without the least exfoliation; and the other three died of typhus. (*Practische Ansichten der bedeutendsten Chir. Op. 1tes. Heft. p. 47.*) In the same work, this experienced surgeon, convinced how much more quickly and certainly the wound heals after amputations with two flaps, than those with one, has suggested a plan of amputating below the knee, so as to form two lateral flaps. I regret that my limits prevent me from entering into a description of it.

I have already specified the principal reasons, which have established the common custom of amputating the leg, about four inches below the patella, and, if the disease or injury will not admit of the operation being done thus low, of removing the limb above the knee joint. In the Egyptian campaign, however, Baron Larrey performed two amputations very near the knee joint, almost on a level with the head of the fibula, which he judged proper to extirpate. The successful result of these operations dispelled the fear, which this experienced surgeon previously entertained about amputating in the thick part of the upper head of the tibia; for, no caries of this spongy portion of the bone, no bad effects on the knee-joint, and no ankylosis of the stump ensued; and, with the difference of a few days, the wound healed as readily, as that made in the common place of election, viz. three or four finger breadths below the tuberosity of the tibia. Since

the above-mentioned campaign, Larrey has adopted this practice in many cases, where it was impossible to have operated at the usual place, and he assures us, the success fully equalled what attends operations done at the ordinary distance from the knee. In 1806, another French military surgeon, who had tried this method himself, published a dissertation, in which he commended operating, where circumstances required it, much higher than the point allowed by generally received rules. Larrey differs, however, from Garrigues, in forbidding amputation higher than the level of the tuberosity of the tibia, the thick portion of which may be sawn, but not above the insertion of the tendon of the patella. A transverse line, drawn from this point, usually passes below the articulation of the fibula, and over the lower portion of the uppermost part of the condyles of the tibia; but as the relative positions of the heads of the two bones to each other differ somewhat in different individuals, Larrey makes the tuberosity of the tibia the point, above which the bone should never be sawn. By cutting higher, the ligament of the patella is separated from its insertion: the bursa mucosa, situated underneath it, is wounded; and the ligaments at the sides of the joint are injured; whence arise retraction of the patella, effusion of the synovia, and such disease of the knee-joint, as may render another amputation indispensable. By making the division on a level with the tuberosity of the tibia, the attachment of the ligament of the patella is preserved, as well as that of the flexor tendons of the leg, which are requisite for the motion of the stump. The bursa mucosa is left untouched; and the head of the bone is sawn low enough to avoid creating a risk of caries. But, says Larrey, if this mode of amputating below the knee be compared with amputation of the thigh, as recommended by authors for the cases in which the new method is proposed, the advantages of the latter are considerable. In the first place, life is less endangered, because a smaller portion of the body is removed. The operation is as easy in one situation as the other. The stumps heal with equal facility. Larrey has never seen the spongy part of the tibia become carious, nor perceptibly exfoliate. When the remaining portion of the fibula is very short, as usually happens, it ought to be taken away, as it is an useless body, inconvenient for the employment of a wooden leg. Larrey directs as much skin as possible to be preserved, and making a perpendicular incision through that part of it, which covers the tibia, in order to hinder the bone from making its way through it by ulceration.

With a stump, thus formed, comprising the knee and one or two finger breadths of the leg, the patient has a firm point of support, on which he can securely walk without a stick. The stump admits also of an artificial leg of the natural shape being worn, the knee being always bent, provided the

length of the stump do not exceed the diameter of the calf of the artificial limb. (*Mem. de Chir. militaire*, T. 3. p. 386—394.) From a passage, quoted from Mr. Bromfield, (*Chir. Obs. & Cases*, vol. 1. p. 185.) by Mr. Guthrie, it would seem, that the first of these gentlemen advised amputating as near to the knee as could be done without risk of cutting the ligament of the patella, so that the stump might not extend beyond the wooden leg. On the whole, Mr. Guthrie's own observations are very favourable to this practice; but he candidly acknowledges his belief, that "it would not succeed when indiscriminately done in the hospitals of large cities," though it may frequently be practised in the army with advantage, provided the surgeon saw through the tibia below its tuberosity. (*On Gunshot Wounds*, p. 223, and 227.) Upon looking over the details of the cases recorded by Larrey in confirmation of the above statement, I was struck with one important fact, which does not justify a part of his commendations; viz. most of the stumps were above four months in healing; and that which healed most quickly was not well before the sixty-eighth day. (*See Mem. de Chir. Mil.* T. 3. p. 57, 397, 398, &c.) Hence, unless it be supposed, that the wounds produced by amputation below the knee in the ordinary manner, are generally thus long in healing, as treated by the French surgeons, the inference is rather unfavourable to the method so highly commended by Larrey, though I am far from wishing to assert that, even if the stumps cannot usually be healed in less time, more than a full compensation for this disadvantage is not obtained by some of the benefits above enumerated. However, in order to be able to pronounce any positive judgment on the merits of this mode of operating, it would be requisite not only to see two or three successful cases just after their cure, but to examine the state of a tolerable number of stumps, sometime after they had been subjected to the pressure of an artificial leg.

AMPUTATION OF THE ARM.

The structure of the arm is very analogous to that of the thigh: like the latter it contains only one bone, round which the muscles are arranged. The interior muscles are attached to the os brachii, while the more superficial ones extend along the limb, without being at all adherent. The first consist of the brachialis internus, and the two short heads of the triceps: the second, of the biceps, and long head of the triceps. Hence, amputation is here to be done in the same way as in the thigh, unless when we are necessitated to amputate very high up, above the insertion of the deltoid muscle. In the arm, says Graefe, the incisions through the muscles should even be made more obliquely upwards than in the thigh, where the muscles are more bulky, by which means two inches of muscle may be saved, besides the retracted integuments; an abundance for covering the

stump, were the arm full ten inches in circumference. (*Normen für die Abl. grosserer, Gliedm.* p. 109.)

The patient being properly seated, the arm is to be raised from the side, and, if the disease will allow it, into a horizontal position. As I have seen some inconveniences produced by the patient's fainting in the midst of the operation, I join Graefe and some other practitioners in thinking that the patient, if circumstances will allow, should be placed upon a table in the recumbent position. (*Normen für die Ablösung grosserer Gliedm.* p. 108.) The surgeon is to stand on the outside of the limb, apply the tourniquet as high as possible, and to have the skin and muscles which he is about to divide, made tense by the hands of an assistant. The soft parts are next to be divided, as much of this limb being preserved as possible. The retractor to be applied, the bone sawn with the usual precautions, and the bleeding stopped in the ordinary way, care being taken to leave the radial nerve out of the ligature, which is put round the brachial artery. The wound is then to be closed so as to form a transverse line, the dressings are to be applied, and the patient put to bed, with the wound a little elevated from the surface of the bedding.

In taking off the arm, I entirely coincide with Mr. Guthrie, with regard to the uselessness of dissecting back the integuments, their effectual retraction by an assistant, after their complete division, being quite enough; (*On Gunshot Wounds*, p. 354.) but, as I have invariably imitated Graefe and others, in making the incisions through the muscles, with the edge of the knife turned very obliquely upwards, it has not appeared to me necessary, after cutting down to the bone in this manner, to clear away the muscles from it to the extent of an inch and a half, or two inches higher. Instead also of attempting to perform the circular oblique incision through the muscles with one stroke of the knife, the objections to which have been noticed in the description of amputation of the thigh, I have made it a rule to divide the loose biceps muscle, as soon as the integuments had been cut and retracted, and of letting it fully recede, before the division of the rest of the soft parts was begun.

If the disease should require the arm to be taken off at its upper part, there would be no room for the application of the tourniquet. Here, instead of putting a compress in the axilla, and having it held firmly upon the artery by a by-stander, as advised by Sabatier, it is more eligible to make pressure on the artery as it passes over the first rib, of which method I shall speak in treating of amputation at the shoulder-joint. With a straight bistoury, the surgeon is now to make a transverse incision down to the bone, a little above the lower extremity of the deltoid muscle. Two other longitudinal incisions made along the front and back edge of this muscle, now form a flap, which must be detached, and reflected. Lastly, the rest of the soft parts of the limb are to

be divided by a circular cut, made on a level with the base of the flap, and the operation finished like a common amputation. (*Sabatier, Médecine Opératoire, t. 3, p. 375, &c. ed. 2.*)

As a matter of choice, and not at all of necessity, the arm may be amputated with two flaps; one anterior; the other posterior. The first should be formed of the skin and biceps, and be three or four inches in length; the other is to be of the same size, and composed of the triceps and integuments. The muscular flesh, close to the bone, is now to be divided all round, and the saw used. Klein of late has preferred this to the common method, having adopted it in nine cases. So well is the end of the bone always covered, that a protrusion of it is impossible. (*Practische Ansichten der Chirurgischen Operationen. p. 44.*)

When the arm is injured very high up, Baron Larrey differs from Sabatier, and prefers amputation at the shoulder joint to preserving a short stump, containing the upper end of the humerus; for, says he, if this bone cannot be divided at least on a level with the tendinous insertion of the deltoid, the stump is retracted towards the arm-pit by the pectoralis major and latissimus dorsi; the ligatures on the vessels irritate the brachial plexus of nerves; great pain, and nervous twitchings, often ending in tetanus, are produced; the stump continues swelled; and, in the end, the humerus is fixed by ankylosis to the shoulder, so that this portion of the arm remains altogether useless, and renders the patient liable to accidents. "I have seen (says Larrey) many officers and soldiers, who, on these accounts, were sorry that they had not undergone amputation at the shoulder." (*Mém de Chir. Mil. T. 3. p. 53, 400.*)

Mr. Guthrie also states, that when amputation by the circular incision is attempted at the insertion of the pectoralis major, the bone will generally protrude after a few dressings. However, he entirely dissents from Larrey, respecting the necessity of taking off the limb at the shoulder, and prefers doing it from half an inch to an inch and a half below the tuberosities of the humerus, as the state of the injury may require. Two incisions are to commence, one or two finger-breadths below the acromion; and the inner one is to be extended directly across the under side of the limb, till it meets the lower point of the outer wound. Thus the under part of the arm is cut by a circular incision; the upper in the same manner as it sometimes is in removing the limb at the shoulder joint. Without detaching the skin from the muscles, these are cut through; the soft parts are held out of the way of the saw; the bone is sawn; the vessels secured; and the flaps brought together, so as to form a line from the acromion downwards. (*Gunshot Wounds, p. 337, &c.*) I am decidedly of opinion, that in the description of cases referred to, either this method, or Sabatier's operation, should be

preferred to the removal of the whole limb at the shoulder joint.

AMPUTATION OF THE FOREARM.

The wisest maxim, with respect to the place for making the incision, is to cut off as little of the limb as possible. This fact is perfectly established, though it is true that Larrey, in consequence of his mode of dressing the stump, has not experienced success in his amputations done in the tendinous part of the forearm. The forearm is to be held by two assistants, one of whom is to take hold of the elbow, the other of the wrist. The tourniquet is to be applied to the lower part of the arm, and the assistant holding the elbow, should draw up the integuments, so as to make them tense. The circular incision is then to be made down to the fascia; from this as much skin is to be detached, reflected and saved, as is necessary for covering the ends of the bones, and the muscles are to be cut on a level with the reflected skin, the knife being at the same time directed obliquely upward. As many of the muscles are deeply situated between the two bones of the forearm, too much attention cannot be paid to dividing all of them, with a double-edged knife introduced between the radius and ulna.

The soft parts are to be protected from the saw by a linen retractor. It is generally recommended to saw the two bones together, for which purpose the forearm should be placed in the utmost state of pronation. In any other position, the ulna is situated almost directly under the radius.

The ulnar, radial, and two interosseous arteries, are those, which usually require a ligature.

Graefe removes the forearm by making a flap from the flesh in front of the limb, and then extending the wound quite round the member. (*Normen für die Ablesung grosserer Gliedm. p. 138, &c. 4to. Berlin, 1812.*) Mr. Guthrie makes two flaps, one in front, the other on the back of the forearm; but, above the middle of this part of the limb, he prefers the circular incision. (*On Gunshot Wounds, p. 373—374.*) Dr. Hennen also expresses his approbation of amputating the forearm, so as to make two semilunar flaps: (*Principles of Military Surgery, p. 265, edit. 2.*) which is the method recommended and practised by Klein. (*Practische Ansichten bedeutendsten operationem Heft, p. 45.*) These flap-operations of the forearm are rather proceedings of choice, than of necessity; for, I have seen this part of the limb removed in numberless instances by the circular incision, and can hardly remember a case, in which the stump turned out badly. In making the inner flap, the radial and ulnar arteries must obviously be in danger of being wounded higher up, than the point where they are quite cut through, as Mr. Guthrie candidly acknowledges; an accident which I think might give rise to a great deal of trouble.

With respect to Larrey's preference to amputating in the fleshy part of the fore-

arm, though the case would admit of the operation being done much lower, I need only say, he would find no reason for this choice, were he to practise union by the first intention, at every opportunity, as is the custom in England.

The hand may be amputated at the joint of the wrist, whenever the disease does not extend too high, and a flap can be made of the integuments of the back of the hand. Richerand thinks such an operation sometimes preferable to amputation above the joint. (*Nosogr. Chirurg. T. 4, p. 506, edit. 4.*)

AMPUTATION AT THE HIP-JOINT.

The very idea of this formidable operation, for a long while, checked the hand even of the most ready advocate for the use of the amputating knife, and every mind shuddered at so extensive a mutilation. Still, it could not be denied that the chance of saving life occasionally depended upon a submission to the greatest temporary suffering, and that without the most cruel of sacrifices, the preservation of the patient was totally impossible. Dreadful as the amputation at the hip appeared, both in respect to the magnitude of the part of the body to be removed, and the extent of the wound caused by such removal, the desperate nature of some cases at length begun to incline surgeons to view more dispassionately a scheme, at which the mind at first must naturally have revolted. Morand is the earliest practitioner, who made this severe operation the subject of considerable attention, (*Opusculs de Chir. T. 1. p. 176, 8vo. 1768.*) and in the year 1739, two essays on the same topic were communicated to the Royal Academy of Surgery at Paris, by two of his pupils, Volner and Pethod. In 1743, Ravaton wished to have performed amputation at the hip-joint in a case of gunshot fracture of the trochanter major, and neck of the thigh bone, but was prevented by the opposition of other surgeons. (*Chir. d'Arm. p. 323, &c.*) In 1748, the propriety of attempting the operation was urged by l'Alouette. (*Disp. Chir. Halleri, t. 5, p. 265.*) At length, the Royal Academy of Surgery at Paris thought the subject highly deserving of further investigation, as it appeared to several of its members, that there were circumstances under which its performance might be advisable. In the year 1756, they therefore proposed the following question, as the grand prize subject; *In the case, in which amputation of the hip-joint should appear to be the only resource for saving the patient's life, to determine whether this operation ought to be practised, and what would be the best way of performing it?* No satisfactory memoirs having been presented, the same subject was proposed in 1759. The approbation of the Academy was now conferred on a paper written by Barbet, in which the propriety of amputating at the hip-joint was defended, and some of the cases demanding the operation specified. If, for instance, a cannon ball, or any other violently contusing cause,

had carried off or crushed the thigh, so as to leave only a few parts to be cut to make the separation complete, he thought a surgeon ought not to hesitate about doing it. The same author conceived that a sphacelus, extending to the circumference of the joint, and destroying the greatest part of the surrounding flesh, might also render the operation equally necessary and easy. (*See Sabatier, Med. Opératoire, t. 3, p. 271, &c.*) Cases were also adduced, where the surgeon completed the separation of the dead parts with a knife. However, this cannot be considered as amputation at the hip-joint. Dividing a few dead fibres was a thing of no importance, in regard to the likelihood of its creating any bad symptoms. The proceeding, in fact, seems to me to have no analogy at all to the bloody operation of taking the thigh bone out of the socket. It is quite a different thing, when the operator has to cut through parts, which bleed profusely, and are endued with life and sensibility.

In addition to the memoir by Barbet, thirty-three other essays were offered to the academy, the majority of which were filled with arguments in favour of the operation; and, besides these productions, two other memoirs were published at Paris, one by Goursand in 1758, explaining a new method of operating, and another by Moublet, (*See Journ. de Médéc. an. 1759.*) in which, says Professor Thomson, the operation is very ably considered in all its different relations. (*Obs. made in the Mil. Hospitals in Belgium, p. 260, 63.*)

Some of the first modern surgeons condemn the proceeding. The following are Mr. Pott's sentiments: "M. Bilguer, and M. Tissot, are the only people whom I have met with, or heard of, in the profession, who speak of an amputation in the joint of the hip, as an advisable thing, or as being preferable to the same operation in the thigh." After a quotation or two, he continues; "that amputation in the joint of the hip is not an impracticable operation (although it be a dreadful one) I very well know. I cannot say, that I have ever done it, but I have seen it done, and am now very sure I shall never do it, unless it be on a dead body. The parallel, which is drawn between this operation and that in the shoulder will not hold. In the latter it sometimes happens, that the caries is confined to the head of the os humeri, and that the scapula is perfectly sound and unaffected. In the case of a carious hip-joint, this never is the fact; the acetabulum ischii, and parts about, are always, more or less, in the same state, or at least in a distempered one, and so indeed most frequently are the parts within the pelvis," &c. (*Pott on Amputation.*) Callisen has difficulty in supposing any circumstances, in which the amputation could be undertaken with hopes of success. (*Syst. Chir. Hod. p. 418. Tom. 2. edit. 1800.*) And Richerand thinks, that, unless the limb be nearly separated by the disease, or accident, a prudent surgeon should decline making

the attempt. (*Nosogr. Chir. Tom. 4. p. 519. edit. 4.*)

As Professor Thomson has justly observed, it is a remarkable fact in the history of surgery, that an operation, which had been invented in France, and concerning which so much had been written in that country, should have been first actually put in practice in England. "I have been informed, (says he) that the operation was performed in London by the late Mr. H. Thomson, Surgeon to the London Hospital, and imagine that it must have been his operation, to which Mr. Pott alludes." (*Obs. made in the Mil. Hospitals in Belgium, p. 264.*) At all events, whether this was the identical case which Mr. Pott saw, or not, the example referred to by this distinguished surgeon is the earliest instance of the operation being actually performed. It was even repeated in this country before it was ever practised on the continent, as far as can be made out from the records of the profession; for, it was performed by Mr. Kerr, of Northampton, on a girl, between eleven and twelve years of age, in a case of diseased hip; a case, in which I am now completely satisfied that it ought never to be attempted, for the reason laid down by Mr. Pott. In fact, Mr. Kerr, after removing the limb, found the acetabulum, and all the adjacent parts of the ossa innominata, carious. But, the experiment was here rendered still more hopeless, by the patient being consumptive. Yet, with all these disadvantages, the girl lived till the eighteenth day from the operation, and, after death, her lungs were found to be a complete mass of disease, one of them being totally reduced to matter. (See *Duncan's Med. Commentaries, vol. 6, p. 337, 8vo. Lond. 1779.*) M. Larrey performed this operation twice in Egypt; and once, while he was a surgeon to the French army on the Rhine. He was encouraged to make these attempts to save his patients by the consideration, that he had already preserved some lives by amputating either both thighs, both legs, or both arms, or removing the humerus at the shoulder joint. Larrey has also the true merit of having first done the operation in the only description of cases, in which perhaps it ought ever to be performed; viz. gunshot injuries of head, neck, and upper part of the femur, with, or without injury of the femoral artery, or where the limb had been carried away by a shell, or cannon-ball, too high up to admit of amputation in the ordinary manner. However, he also regards as fit occasions for amputation at the hip-joint, circumstances in which, from gunshot violence, the limb is seized, or threatened with gangrene, nearly up to the hip. (*Mém. de Chir. Mil. t. 2. p. 185.*)

Severe as the operation is, Larrey contends, that it is an act of humanity, if it ever is the means of saving lives, which are in danger, and, he argues, that it is justifiable by the old maxim of Hippocrates, "Ad extremos morbos extrema remedia." To the chief objections, which have been made to

it, he replies, 1st, That the wound is more alarming than dangerous. The Cæsarean operation, (says he) has been successfully performed on the living female, and is still recommended by many practitioners. L'Aumonier, principal surgeon of the Rouen Hospital, has successfully removed a scirrhous ovary of considerable size. Examples are recorded of the arm and scapula being torn away, and the patients soon recovering. Besides, the surgeon has it in his power to lessen the wound, produced by the operation. 2dly. The dangers of hemorrhage may be obviated by the assistants temporarily placing their fingers on the mouths of the cut vessels, until ligatures can be applied.

In confirmation of his sentiments, concerning the propriety of the operation, Larrey adverts to a fact reported by Morand, where a soldier had both his legs amputated very high up, and also both his arms so near the shoulders, that he could hold nothing in his armpits. Yet, mutilated as he was, he enjoyed good health. (*Opusculs de Chir. p. 183.*) And Larrey, in his own work, has recorded several instances, in which the whole of a limb was removed, or more than the halves of both the upper or lower extremities of the same subject, without any fatal constitutional disturbance. (*Mém. de Chir. Mil. t. 2. p. 182-184.*) One of his patients above alluded to, survived the operation a week, at the end of which he was carried off by the plague; and the others died, after being conveyed, in a very uneasy manner, during the precipitate march of the army. (See *Relation de l'Expedition de l'Armée d'Orient en Egypt, &c. p. 319, 8vo. Paris, 1803.*) At the battle of Wagram, Larrey operated at the hip-joint on two soldiers of the imperial guard, under very unfavourable circumstances; and the events were fatal in a few hours. (*Mém. de Chir. Mil. T. 3, p. 349.*)

Larrey used to operate as follows: he began with making an incision in the track of the inguinal artery in the bend of the groin, and, after carefully excluding the nerve, which is more externally situated, he tied this vessel, with the aid of a semi-circular curved needle, as closely as possible to Poupart's ligament, in order that the ligature, which was placed above the origin of the circumflex arteries and the profunda, might obviate all inconvenience from the bleeding, which might otherwise happen from their numerous branches. This being done, a straight knife was perpendicularly plunged between the tendons of the muscles attached to the trochanter minor and the base of the neck of the femur, so as to bring out its point at the back part of the limb, or in a diametrically opposite situation to its first entrance; and now by directing the knife obliquely inwards and downwards, a flap, which was not to be too large, was made of the soft parts at the inner and upper portion of the limb. This flap was now drawn towards the scrotum by an assistant, and the articulation was brought into view.

The obturator artery, and some branches of the pudental, wounded by making the flap, were immediately tied. The thigh was now put into the state of abduction; the inner part of the orbicular ligament, made tense by this position, was divided, and the joint opened. The ligamentum teres was then to be cut, and the bone dislocated. The knife was next to be brought to the outside of the great trochanter, and an external flap formed of the soft parts, calculated to meet that which had been made at the inside of the limb. In proceeding through the operation, Larrey secured, as soon as they were divided, the obturator arteries, and several branches of the pudental, gluteal, and ischiatic arteries. The two flaps were brought together, and kept in this position, with strips of adhesive plaster, and a woolen spica bandage. (See *Mém. de Chir. Mil.* t. 2. p. 186, 188.)

In the Russian Campaign, Larrey had two more opportunities of amputating at the hip-joint. In the first instance, he operated upon a Russian at Witepsk, whose thigh bone was broken to pieces up to the trochanter, and the soft parts of two-thirds of the thickness of the limb destroyed. This man went on as favourably as possible until the 25th day from the operation, the parts being healed except at two points, where the ligatures had been brought out; but, unfortunately a scarcity of provisions now occurred from some neglect, or another; and the patient on the 29th or 30th day, fell a victim. The second operation was done on a French dragoon after the battle of Mozaïsk, who was afterwards seen perfectly cured by the surgeon-major, at Orcha, who received him there, and made a report of the fact to Larrey by letter. (See *Mém. de Chir. Mil.* T. 4, p. 26-50-51, 8vo. Paris, 1817.)

In 1812, M. Baffos, surgeon to the Hôpital des Enfants Malades at Paris, amputated at the hip nearly in the manner of Larrey, except that he only compressed the artery in the groin, and did not begin with tying it, a method to which Larrey himself now gives the preference. (See *Mém. de Chir. Mil.* T. 4. p. 434.) The patient was a child, seven years old, and the case a diseased hip. The patient got well of the wound; but died of a scrofula, three months afterwards. The cotyloid cavity was found full of fungous flesh, and the os innominatum carious. As the latter state always exists in the diseased hip-joint, the whole of the disease does not admit of removal by amputation, and consequently the attempt ought never to be made. (See *Joints, Diseases of.*)

The plan of operating, adopted by Baffos, is considered, I believe, by all surgeons of the present day, better than that formerly advised by Larrey, inasmuch as the objectionable and unnecessary preliminary measure of taking up the artery in the groin, instead of simply compressing it against the os pubis, was rejected. Cutting down to the artery as a precaution against hemorrhage, is doing a double operation, and put-

ting the patient to needless suffering: It was the earliest method, having been proposed by Volther and Puthod. Who was the first proposer to press the artery against the os pubis, instead of cutting down to the vessel, I am not at present aware; but I know that it has been publicly recommended by Mr. Abernethy, in his anatomical lectures for the last thirty years: it is twenty-three years since I began to attend his courses, and, in the exhibition of this operation, by the circular incision upon the dead subject, compression of the artery in the groin was then advised, and, as I have stated, not for the first time. Larrey's practice also of running a long narrow knife through the limb, in order to form the inner flap, is highly objectionable, as the parts can never be divided in this vague manner without considerable irregularity. I am glad to find Mr. Guthrie has entered his protest against it, and recommended making the incisions for both flaps from without inwards; (*On Gunshot Wounds*, p. 178.) an improvement, which would have been right in advising for other flap-amputations.

When serving with the army in Holland in 1814, I assisted Dr. Cole in the performance of this operation. The plan adopted by him, is the same as has been taught by Mr. Abernethy, in his lectures for the last thirty years. The flow of blood through the femoral artery was stopped by compressing the vessel in the groin with the handle of a key covered with lint. The thigh was then amputated as high as possible, close below the trochanters. The femoral artery was immediately secured, and afterwards every other vessel requiring ligature. An incision was now made directly on the acetabulum, and the head of the bone removed with the utmost facility and expedition. The patient lost even less blood, than in an ordinary amputation, and the wound admitted of being brought together with adhesive plaster in the best manner possible, so as to represent a transverse line. I am sorry to add, that the patient lived only till the following day. In one dreadful case of fracture of the upper part of the femur by a grape shot, when the operation had been delayed too long, the whole limb being inundated with matter, and the upper end of the lower portion of the bone projecting through the flesh backward, I ventured to perform the same operation at Oudenbosch in Holland, a few days after the assault on Bergen-op-Zoon; and, here happened, what must often occur; instantly after the division of the soft parts, the bone being broken to pieces, the limb came off, leaving the head of the bone, the trochanters, and a small piece below them projecting. Had not the man appeared in a very bad way by the time the vessels had been secured, I should now have removed the head of the bone; but, the shock of the operation was such, that he survived it but a few minutes, though scarcely any blood was lost. The mode of operating, by the circular incision is preferred by Graefe, who unknowingly appears to consider it as a new me-

thod. (*Normen für die Abl. grösserer Gliedm.* p. 118.) It has also been proposed by Mr. Veitch, with the modification of leaving an inch or two of the bone projecting, which is done, without giving any additional pain, by dissecting off the soft parts below the first incisions down to the bone. This projecting piece is intended to serve as a lever, with which the head of the bone is to be got out of the acetabulum. (*Edinb. Med. and Surg. Journ.* vol. 3, p. 129.) Ingenious as this suggestion may be, I do not regard it as an important practical improvement; 1st, because in almost all cases, where the operation is necessary, the bone is so fractured, that its division is already made by the injury: 2dly, because the scheme is unnecessary; for in Dr. Cole's case, where I assisted, the head of the femur was removed from the acetabulum with the utmost facility, by merely making an incision over that cavity, cutting the ligaments, and availing ourselves of the small piece of bone accidentally projecting. In fact, in all gunshot injuries, requiring this operation, excepting a few instances of spreading gangrene from wounds, the bone is usually broken too high for Mr. Veitch's method to be practicable. With the same view of facilitating the exit of the head of the bone from the acetabulum, Graefe (p. 123.) recommends dividing the transverse ligament completing the brim of the anterior and inferior side of the socket. From my having once seen one of the first anatomists in London, with a powerful young assistant, and the whole length of the unbroken femur for a lever, baffled for nearly half an hour before he could dislocate the head of the bone, I supposed Graefe's maxim worth collecting.

I am acquainted with only three cases, in which amputation at the hip-joint proved successful. The first operation was that done by Mr. Brownrigg, surgeon to the forces, on the 12th of December, 1812. The upper part of the thigh bone had been broken by a gunshot, near Merida, in Spain, the 29th of December, 1811. The man was some time ago living at Spalding, in Lincolnshire, in perfect health.

The second successful operation was that performed by Larrey, at Witepsk.

The third was done by Mr. Guthrie, in the Netherlands, on a French prisoner of war, who completely recovered.

On the other hand, the examples which have failed are numerous, though undertaken by surgeons of reputation and ability. Mr. Guthrie, Dr. Emery, Mr. Brownrigg, Larrey, Mr. Brodie, Drs. Blick and Cole, and many other military practitioners, have had opportunities of amputating at the hip without success.

No one can expect, however, this operation not to fail in a large proportion of the cases, in which it is attempted: this must always happen, let it be done in the most skilful manner possible. Yet, as there are unquestionably some descriptions of injury, where life must inevitably be lost, if this proceeding be rejected: and experience

proves, that it sometimes answers: an important consideration is, what cases are most proper for it? Here I am decidedly of opinion, with Professor Thomson, that the examples, in which it is particularly called for, and where no delay should be suffered, are those in which the head or neck of the thigh bone has been fractured by a musket-ball, grape shot, or small piece of shell. Eight or ten such cases, where amputation ought to have been done in the first instance, were brought in wagons, several days after the assault on Bergen-op-Zoom, into the hospital, superintended by myself, at Oudenbosch, and not one of these patients lived ten days after their removal. In the whole course of my professional life, I have never elsewhere witnessed so much suffering, or suppuration in such profusion. From each limb, I should guess, that at least three, or four pints of matter were discharged daily. Had amputation at the hip been performed at first, some of these patients might possibly have been saved; at all events, I am certain, that it was their only chance.

Larrey, as I have stated, thinks the operation proper, where the thigh has been shot off high up, or where the femur and soft parts near the hip have been broken, and extensively lacerated by a cannon-ball, or pieces of shell. Here the operation (though perhaps the only chance) must almost always fail, because, as Professor Thomson observes, these injuries occasion a shock to the constitution, of which the patient mostly sinks either immediately, or in a few hours. (*Obs. made in the Mil. Hosp. in Belgium*, p. 274.) The truth of this observation I saw exemplified at Merxham, near Antwerp, at the bombardment of the French fleet in that port. A shell burst between the thighs of one of the guards; tore and lacerated two-thirds of the thickness of the upper part of the right thigh; broke the ascending ramus of the ischium; lacerated the perineum and scrotum; and fractured the higher part of the femur. There was no hemorrhage of consequence; but the exposed lacerated surface of the soft parts was immense; and the unfortunate patient, who lay with his hairs standing erect, and bereft of his intellectual faculties, sunk in the course of a quarter of an hour into a state of insensibility, and was quite dead in twenty minutes. However, there are numerous cases, in which the patients, after dreadful injuries of the upper part of the thigh, are less depressed and overcome, and live several weeks; facts clearly proving that the operation ought to be attempted. Many instances of this kind are related by Mr. Guthrie. (*On Gunshot Wounds*, p. 134, &c.) This last work, and Baron Larrey's *Mémoire de Chir. Mil.*, contain the most valuable information respecting this operation. The propriety of the operation in desperate cases is now perfectly established; and beginning to be acknowledged by the best surgeons in Europe; Walther (*Abh. aus dem*

Gebiete der Praktischen Med. &c.) Paroisse (*Opusc. de Chir. p. 208*;) Graefe (*Normen, &c. 4to. Berlin, 1812.*) The sentiments of these three surgeons, however, are not founded upon any cases of their own, in which the operation was performed; yet as being men of considerable experience and talents, their sanction may be proper, as a counterbalance to the opinions of some other men of eminence, who, without any personal experience of their own, have condemned the proceeding, as unfit to be attempted.

AMPUTATION AT THE SHOULDER JOINT.

H. F. Le Dran performed the first operation of this kind, of which the particulars are recorded. It was in a case of caries and exostosis, reaching from the middle to the neck of the humerus. Le Dran began with rendering himself master of the bleeding; for which purpose, he introduced a straight needle, and a strong ligature under the artery. This was passed from the front to the back part of the arm, as closely to the axilla and bone as possible. The ligature, then including the vessels, the flesh surrounding them, and the skin covering them, was tightened over a compress. Le Dran, with a straight narrow knife, then made a transverse incision through the skin and deltoid muscle down to the joint, and through the ligament surrounding the head of the humerus. An assistant now raised the arm, and dislocated the head of the bone from the cavity of the scapula. This allowed the knife to be passed with ease between the bone and the flesh. Le Dran then carried the knife downward, keeping its edge always somewhat inclined towards the bone. In this manner, he gradually cut through all the parts, as far as a little below the ligature. As there was a large flap, Le Dran made a second ligature with a curved needle, which ligature included a great deal of flesh, the redundant portion of which was cut off together with the first ligature, which had become useless. The cure was completed in about ten weeks. (*Obs. de Chir. T. 1, p. 315, Paris 1731; and Traité de Opér. p. 365.*) Le Dran (the son) who published this memorable case, does not state, that the operation was a new one, and it appears, from the *Recherches Critiques sur l'origine, &c. de la Chirurgie en France*, and from La Faye's notes on Dionis, that it had been previously practised by Morand, the father.

Garengot thought that the ligature might be applied by means of a curved needle, with sharp edges, and, in order to lessen the wound, he directs the incision to begin two or three finger-breadths below the acromion, across the deltoid muscle, so as to form one flap, then a lower one was made in the axilla; and after the second ligature had been applied, the two flaps were brought into contact. (*Traité des Opér. de Chir. t. 3. p. 350, Mém. de Acad. de Chir. T. 2, p. 261.*)

La Faye extended the improvements further. After placing the patient in a chair, and bringing the arm into a horizontal position, he made, with a common bistoury, a transverse incision into the deltoid muscle down to the bone, four finger-breadths below the acromion. Two other incisions, one in front, the other behind, descended perpendicularly to this first, and made a large flap of the figure of a trapezium, which was detached and turned up towards the top of the shoulder. The two heads of the biceps, the tendons of the supra-spinatus, infra-spinatus, teres minor and subscapularis, and the capsular ligament, were next divided. Now, when the assistant, who held the lower part of the limb, made the bone describe the motion of a lever upward, the head of the bone was easily dislocated. La Faye next carried his incision downward, along the inner part of the arm, until he was able to feel the vessels, which he tied as near the axilla as possible. The separation of the limb was then completed a finger's breadth below the ligature. The flap was then brought down over the glenoid cavity, and the wound was dressed. (*See Nouvelle Méthode pour faire l'Opération de l'Amputation dans l'articulation du Bras avec l'Omoplate, par M. La Faye, in Mém. de l'Acad. de Chirurgie, Tom. 5, p. 195, Edit. in 12mo.*) With respect to La Faye, it is curious to remark a coincidence between him and Larrey: the latter, though generally averse to attempt to unite stumps by the first intention, is an advocate for this practice after hip-joint amputations; so La Faye, who was fearful of laying down the flap, after amputation of the leg, had no such apprehension at the shoulder.

La Faye's method is yet regarded as one of the most approved, where the state of the soft parts will admit of it. But, it is absurd to think of applying any one plan to all the various states, in which the injured or diseased limb may present itself.

It is advised by Larrey himself, when a wound extends through the upper part of the arm, breaking the bone, and injuring the soft parts. Here, says he, it would be impossible to form an anterior and a posterior flap, for the soft parts in these situations have been destroyed. On the contrary, when the deltoid is shot away, La Faye's plan is inadmissible. (*Mém. de Chir. Mil. T. 2. p. 167.*)

The advantages of La Faye's plan are obvious. As only one ligature was applied, the patient was saved a great deal of pain: the flap connected with the acromion was capable of covering the whole surface of the wound, and was more easily applied and kept on the stump, than the lowermost of the two flaps which Garengot recommended; and the discharge found a ready outlet downwards.

Mr. S. Sharp recommended the following plan. "The patient's arm being held horizontally, make an incision through the membrana adiposa, from the upper part of

the shoulder across the pectoral muscle, down to the arm-pit, then turning the knife with its edge upwards, divide that muscle and part of the deltoid, all which may be done without danger of wounding the great vessels, which will become exposed by these openings. If they be not, cut still more of the deltoid muscle, and carry the arm backward. Then with a strong ligature, having tied the artery and vein, pursue the circular incision through the joint, and carefully divide the vessels at a considerable distance below the ligature; the other small vessels are to be stopped, as in other cases.

"In doing this operation, regard should be had to the saving as much skin as possible, and to the situation of the processus acromion, which, projecting considerably beyond the joint, an unwary operator would be apt to cut upon." (*Operations of Surgery*.)

Bromfield used to have pressure made on the artery above the clavicle. His incision began on the inside of the arm, by the edge of the deltoid muscle, as high up as where the pectoralis goes over the axilla, to its insertion into the humerus. Cutting through the integuments and muscles, he continued his incision obliquely downwards, and outwards, as far as a little below the termination of the deltoid muscle. Then carrying on the incision transversely for a small space in a semicircular direction, the wound was next extended to the external part of the arm, as high up as the fold of the integuments in the axilla. The flap, thus shaped, when raised from the humerus, was intended to fill up the axilla, after the removal of the limb. Bromfield's next incision began at the acromion, and, being carried through the skin and deltoid down to the bone, terminated in the semicircular incision above described, and it was so guided, that it left the outer portion of the divided flap larger than the inner one. Bromfield then passed his knife under the lower edge of the internal half-flap, and dissected it up as high as possible. The tendon of the pectoral muscle was thus exposed, under which he now passed his left forefinger, which served as a conductor to a probe-pointed curved bistoury. With this, he now divided the attachment of that muscle to the humerus. If the vessels were not now sufficiently brought into view, he cut through the outer head of the biceps, and tied them (artery and vein) each with two strong ligatures about half an inch apart. The vessels were then cut through in the interspace, and the nerve was divided much higher than the artery. The external flap was now raised sufficiently to expose the joint; and the muscles and capsular ligament having been cut through in the superior and lateral parts, the humerus slipped out of the glenoid cavity, immediately the arm was carried a little backward. Lastly, the ligatures and vessels being held out of the way, the soft parts towards the axilla were divided in a

semicircular direction. (*Chir. Obs. and Cases*, vol. 1. p. 249—252. 8vo. London, 1773.) The unnecessary tediousness, and, I may add, severity of Bromfield's method, have long withdrawn from it the approbation of modern operators. The division of the flap into two portions; its extraordinary length; and the painful dissection practised to get at the artery; were serious faults in the operation.

In 1774, Alanson amputated at the shoulder-joint, as follows: the subclavian artery was compressed by the fingers of an assistant. An incision was made about a hand's breadth below the acromion, and carried through the integuments all round the limb. The deltoid and posterior muscles were then obliquely divided up to the capsular ligament. The tendon of the biceps, and the capsular ligament upon the anterior and posterior part of the joint, were now cut through. One of the circumflex arteries, which bleed a good deal, was next tied. The great pectoral muscle, the rest of the capsule, and all the other parts, except the vessels and nerves, were then divided, but, previously to cutting the vessels, a temporary ligature was put round them. Thus the separation of the limb was completed. The mouths of the vessels were drawn out, and tied, and the temporary ligature taken away. Lastly, the sides of the wound were brought together, so as to make a transverse line. Graefe, seeming not to recollect that amputation by the circular incision directed obliquely upwards, had been practised by Alanson, mentions it as a new proposition. In one case, after operating in this manner, his patient was quite well in three weeks; and, with the particular sort of knife which he uses, and which is broadest towards its point, he pretends to be able to make the oblique incision through the muscles all round the limb with one sweep. Of course, he is very careful to make pressure on the artery, both with Mohrenheim's compressor applied under the clavicle, and the fingers of an assistant above it. (See *Normen für die Abl. grosserer Gliedm.* p. 110, &c.) In proof of the possibility of making the oblique incision quite evenly with one stroke of his particular knife, he injected a female subject, did the operation, and caused the stump to be drawn from nature. (See *Plate 2, of his Work*.)

In 1760, P. H. Dahl published at Göttingen a Latin dissertation on amputation at the shoulder. In this tract a tourniquet was proposed, the pad of which was calculated to press upon the subclavian artery under the clavicle, and enabled the operator to dispense with tying the vessels in the first instance. Camper had observed, that if the scapula were pushed backward, and the axillary artery pressed with the finger between the clavicle, coracoid process, and great pectoral muscle, the pulse at the wrist might be instantly stopped.

Dahl's tourniquet was obviously constructed, in consequence of what Camper

had observed. It is made of a curved, elastic plate of steel, to the shortest end of which a pad is attached, capable of projecting further by means of a screw. The instrument embraces the shoulder from behind forward, while the pad presses on the hollow under the clavicle, between the margins of the deltoid and pectoral muscles. The long extremity of the steel plate, which descends behind the shoulder, is fixed to the body by a sort of belt. The pad is depressed, until the pulsation of the axillary artery is stopped.

Further experiments have proved, however, that this tourniquet may be dispensed with, and the flow of blood in the axillary commanded, by properly compressing this vessel with a pad, or even the fingers alone, as some operators prefer, at the place where it emerges from between the scaleni muscles, above the middle part of the clavicle. Thus the artery is pressed between the pad or fingers and the first rib, across which it runs. In some plans of operation, hereafter to be described, all compression of the artery, either above or below the clavicle, is dispensed with.

Some practitioners, forgetful of the horizontal posture in which the patient is usually placed after the operation, have feared that, in La Faye's method, the lower flap may sometimes confine the discharge. In order to avoid this inconvenience, Desault recommended the formation of two flaps, one of which was anterior, the other posterior. The axillary artery was compressed from above the clavicle, at its coming out from between the scaleni muscles, while the integuments and flesh of the upper and internal part of the arm were pushed away from the humerus. A knife was plunged between these and the other soft parts behind, to make the anterior flap. The arm being inclined backward and outward, the humeral artery was tied, the articulation opened, and the head of the bone dislocated. The knife was then carried downward and backward, so as to form the posterior flap; the incisions meeting in the axilla. (See *Sabatier's Médecine Opératoire*, t. 3. p. 393—399. edit. 2.)

Larrey, who has had frequent opportunities of amputating at the shoulder-joint, has aimed at the same object which Desault did, but, in his earlier operations, he was in the habit of beginning with the formation of the external, or posterior flap, for the following reason: by proceeding in this way, the surgeon can tie the humeral artery more safely, because the ligature is applied after the operation is entirely finished, and consequently at a time when there is nothing to be attended to but the hemorrhage. Thus, the patient being placed on a stool, and well supported, the arm is to be raised from the side, and the axillary artery compressed from above the clavicle. The integuments and other soft parts of the upper and outer parts of the arm are then to be pushed away from the humerus, and the external flap formed. It is now very easy

to cut the tendons of the infra-spinatus, and teres minor, and open the outside of the joint. The limb is to be carried inward, and luxated backward. The tendons of the supra-spinatus and biceps are to be divided, and as soon as the head of the bone is out of the glenoid cavity, the knife is to be carried along the internal part of the head and neck of the humerus, with its edge close to the bone. An internal flap, equal to the external one, is to be formed, consisting of a portion of the deltoid, great pectoral, biceps, and coraco-brachialis, muscles, and including the brachial vessels and nerves. The artery is to be taken hold of with a pair of forceps, and tied. Any other vessels, which require a ligature, are also now to be secured. Larrey puts some charpie betwixt the flaps, and brings them towards each other by the usual means. (See *Mém. de Chir. Militaire*, t. 2. p. 170.) Of this method of putting charpie to prevent union by the first intention, I entertain the most unfavourable opinion.

When Larrey published his campaign in Egypt, he had operated in this way on nineteen patients, thirteen of whom recovered. But, at a subsequent period, he and his colleagues had amputated at the shoulder, in the above manner, in upwards of a hundred cases, more than ninety of which recovered. (*Mém. de Chir. Mil.* t. 4. p. 432. 8vo. Paris, 1817.)

In his later operations, he has adopted the innovation of first making a longitudinal incision from the acromion to about an inch below the neck of the humerus, down to the bone, so as to divide the fleshy part of the deltoid into two even parts. This cut, he says, facilitates and renders more exact the rest of the operation. From this wound, the incisions for the flaps are continued. Having made the foregoing incision, "I direct an assistant to draw up the skin of the arm towards the shoulder, and I form the anterior and posterior flaps by two oblique strokes of the knife made from within outwards and downwards, so as to cut through the tendons of the pectoralis major and latissimus dorsi. There is no risk of injuring the axillary vessels, as they are out of the reach of the point of the knife. The cellular connexions of these two flaps are to be divided, and the flaps themselves raised by an assistant, who, at the same time, is to compress the two divided circumflex arteries. The whole joint is now exposed. By a third sweep of the knife, carried circularly over the head of the humerus, the capsule and tendons running near the articulation are cut; and the head of the bone being inclined a little outwards, the knife is to be carried along its posterior part, in order to finish the section of the tendinous and ligamentous attachments in that direction. The assistant now applies his forefingers over the brachial plexus, for the purpose of compressing the artery, and commanding the current of blood through it. Lastly, the edge of the knife is turned backwards, and the whole

fasciculus of axillary vessels are cut through, on a level with the lower angles of the two flaps, and in front of the assistant's fingers. The patient does not lose a drop of blood; and ere the compression is remitted, the extremity of the axillary artery is readily seen, taken up with a pair of forceps, and tied. The circumflex arteries are next secured, which completes the operation." (*Mém. de Chir. Mil. t. 4. p. 428. Paris, 1817.*) In addition to these important deviations from his earlier method, he now brings the flaps together with two or three straps of adhesive plaster, and interposes no charpie. (P. 429.) It should be observed, also, that he lays no stress on first making the outer flap; though, from the description, it does not exactly appear which flap he now begins with. He has changed, likewise, on another point of importance; viz. instead of preferring La Faye's plan, in certain examples already specified, he affirms, that the above described way of operating is applicable to almost every case met with in military practice. First, because all gunshot wounds, generally, which mutilate the arm, so as to create the necessity for the operation, partly or entirely destroy the centre of the deltoid, while there is always enough flesh left at the sides for making the two flaps. Secondly, because, in the very rare instances, where the lateral parts of the shoulder are destroyed, and the middle untouched, no advantage would be gained by operating in La Faye's manner, as Larrey conceives that the detached flap would slough or become, as he terms it, disorganized. Here Larrey now prefers dividing the middle piece of flesh, and giving the flaps the same shape as if they were uninjured. He even asserts, that the operation, done without any flaps at all, answers better, than any method, in which the surgeon preserves flaps not naturally intended for the part. Thus, when all the flesh of the shoulder has been shot away, he has seen surgeons cover the glenoid cavity with a flap, saved from the soft parts of the axilla; but such flaps invariably sloughed, hemorrhages ensued, and the patients died. (P. 430, 431.) Some of these latter observations are, clearly enough, the result of great partiality to a particular method of operating; because who can doubt, when the lateral parts of the shoulder are injured, as they frequently are (and not very rarely, as Larrey asserts,) by the passage of a musket-ball through the shoulder, from before backwards, that the right method is that of La Faye; or the same operation, with the slight difference of making the flap of a semicircular shape? It was for cases of this description that Mr. Collier and I operated after La Faye's plan, with perfect success, after the battle of Waterloo; and a poor fellow of the rifle brigade, who was brought in too late for operation, and died of sloughing, had his shoulder injured in the same way, the middle of the deltoid being untouched, and shot-holes behind, and in front of, the

articulation. But, if it require any further arguments to prove, that Larrey is wrong in wishing to extend his, or rather Desault's method, to all cases, I might criticise his assertions about the sloughing of the flap, when it is not cut into two portions, and its preservation by the singular expedient of making a division of it, and of course, injuring it still more, than it may have been injured underneath by the bullet. The cases, however, which have fallen under my own personal observation, and numerous others on record, furnish an adequate proof, that, excellent as Larrey's method is for many cases, La Faye's answers very well in others. Thus, in an example where a Prussian hussar had had his arm amputated, and a projection of the bone took place, to the extent of three inches, with hospital gangrene commencing in the stump, Klein felt obliged to remove the limb at the shoulder. He operated in La Faye's manner; the separation was finished in one minute; and, on the eighteenth day, the stump was perfectly healed. (See *Practische Ansichte Chir. op. h. 1. p. 1—10. 4to. Stuttgart, 1816.*) The same practitioner had five other secondary amputations of the same kind; but one patient was afterwards carried off by the hemorrhage, and another by hospital gangrene. Klein, however, in common with the majority of army surgeons, considers the idea of applying any one plan of operating, to different cases, totally absurd. (P. 12.) After the storming of St. Sebastian's, nine shoulder-joint amputations were done with success: seven of them by raising the deltoid as a flap. (See *Guthrie on Gunshot Wounds, p. 108.*)

After the battle of Waterloo, I adopted La Faye's plan; but with this difference, that I did not cut the brachial artery till I made the last stroke of the knife, which separated the limb, and consequently I did not tie the vessel till the time when I had nothing but the hemorrhage to occupy my attention. The circumflex arteries however, I tied as soon as the external flap was made. The modification of thrusting a knife under the deltoid, quite across the shoulder, and making the flap by cutting downwards, until the instrument comes out again through the skin, as practised by some surgeons of eminence (*Klein, &c.*;) but this is a method which I should never choose to follow, as the flesh may be more smoothly and accurately cut from without inwards. This is a principle which, in my opinion, ought to apply to every flap-amputation.

When the state of the integuments will permit the choice, Mr. Guthrie thinks their preservation best effected by Larrey's first method; but he particularly insists upon the advantage of raising the shattered arm, or stump, to nearly a right angle with the body, before the operation begins, and even before the assistant makes pressure on the subclavian artery, as some change in the mode of accomplishing the latter object might be rendered necessary by elevating the limb during the operation itself. Mr.

Guthrie commences the first incision immediately below the acromion, and with a gentle curve, extends it downwards and inwards, through the integuments only, a little below the anterior fold of the armpit. The second incision outwards is made after the same manner, but is carried rather further down, so as to expose the long head of the triceps at the under edge of the deltoid. The third incision, commencing at the same spot as the first, but following the margin of the retracted skin, divides the deltoid on that side down to the bone, and exposes the insertion of the pectoralis major, which must be cut through. This flap is now to be raised, so as to expose the head of the bone. The fourth incision outwards divides the deltoid muscle down to the bone, when the posterior flap is to be well turned back, so as to bring into view the teres minor and infra-spinatus passing from the scapula to the great tuberosity of the humerus. The outer and inner flap being now raised, the head of the bone may be rolled a little outwards, the teres minor and infra-spinatus cut, and an opening made into the joint. The capsular ligament, supra-spinatus, and long head of the biceps are then divided. The inner side of the capsule is now cut through, together with the subscapularis muscle, as it approaches its insertion, into the lesser tuberosity of the humerus. The long head of the triceps is next divided, and, lastly, with one sweep of the knife, the rest of the soft parts are cut, together with the axillary artery, veins, and nerve. (*On Gun-shot Wounds*, p. 274-276.) The doubtful part of this method seems to be, that of cutting the circumflex arteries twice, which, when they bleed much, ought to be secured without any delay, more especially in secondary operations, where every drop of blood is of consequence. The principle laid down by Desault, that in operative surgery in general, all important vessels should be tied, if possible, ere other things are done, is one of the most valuable maxims which can be inculcated. On this point I should more strongly differ from Larrey, who, in his latest method, takes no measures in the first stage of the operation for commanding the flow of blood, as the assistant merely presses the axillary artery between his fingers just before it is divided.

Some of the modern French surgeons were earlier, than Larrey, in dispensing with the compression of the axillary artery, and following a method which renders it unnecessary. Richerand, for instance, describes nearly the same plan as was advised by La Faye; but after making the deltoid flap, cutting the tendons, and dislocating the bone, he dissects down close to the inside of the humerus, so as to enable an intelligent assistant to put his thumb on the cut surface behind the artery, which, with the aid of the four fingers, applied to the skin of the axilla, can then be grasped and compressed, so as to command the flow of blood through the vessel. The operator now, fearless of hemorrhage, com-

pletes the incision of the internal or inferior flap.—(*Richerand, Nosographie Chirurgicale*, t. 4. p. 509-511. edit. 4.)

Dupuytren, surgeon to the Hotel-Dieu, at Paris, amputated at the shoulder, in a manner which seems principally commendable on account of its celerity. The arm being raised and held at a right angle with the trunk, Dupuytren stands at the inside of the limb, with one hand grasps and elevates the mass of the deltoid muscle, and plunges under a two-edged knife, from before backward, on a level with the end of the acromion. Cutting in this way, close to the head of the humerus, he continues the incision downward between this bone and the deltoid, and at length bringing out the knife, completes the external or superior flap. The rest of the operation does not essentially differ from Richerand's, except that M. Dupuytren takes hold of the lower flap itself, before dividing it, and compresses the artery, until he has cut through it, and tied it.

Dupuytren's plan would be difficult on the left side, unless the surgeon were an ambidexter; but in other respects, it cannot be found much fault with. This surgeon has also proposed making one flap in front, and the other behind, in order to prevent the lodgment of matter. Richerand justly observes, however, that frequently a good deal of the wound unites by the first intention, and that as the patient after the operation lies in the recumbent posture on an oblique plane, he cannot see what advantage one way of making the flaps has over another, in regard to affording a ready issue to the discharge. (*Op. cit.* p. 515.)

For the sake of celerity, of which the French are rightly admirers in all capital operations, another plan of amputating at the shoulder has been proposed by Champesme and Lysfranc. In front of the fleshy part of the shoulder, and the scapular end of the clavicle, there is a slight triangular depression. Into the middle of this a narrow double-edged bistoury is introduced. The instrument enters the joint, the head of the humerus not being in contact with the surface of the glenoid cavity of the scapula, when the arm is left to its own weight, and allowed to hang down by the side of the body. The incision is then carried round to make the external flap; and the head of the bone, which becomes more and more distant from the scapula, is easily dislocated, the tendons of the supra and infra-spinatus muscles having been cut in the beginning of the operation. Lastly, the internal flap is made in the way practised by Dupuytren, Richerand, &c.

Speaking of this mode of operating, Richerand remarks: "en l'employant, on parvient à désarticuler l'humérus, et à séparer le bras en aussi peu de temps qu'en met un habile découpeur à détacher l'aile d'un perdrix." (*P. 514.*)

When the scapula is shattered, of course the loose fragments should be taken away; and, if the acromion be broken, and the remnant of it pointed and irregular, this

sharp rough portion should be sawn off, as was practised long ago by M. Faure. (See *Mém. de l'Acad. de Chir.* t. 6. p. 114.) In one case, indeed, Larrey found it necessary to take away more than two-thirds of the scapula, and the humeral end of the clavicle. (*Mém. de Chir. Mil.* t. 4. p. 432.) Sawing off, part of the acromion, and coracoid process, as a general rule, seems to me quite unnecessary (See *Frazer on the Shoulder-joint Operation*, 8vo. Lond. 1813,) and improper, not only as producing delay, but by wounding other parts which should not be at all disturbed. (See *Guthrie on Gunshot Wounds*, p. 285, 286, &c.) The practice of scraping away the cartilage of the glenoid cavity, except when it is diseased, is not of greater value.

Amputation at the shoulder has been partly superseded by a preferable operation, even in cases in which it would formerly have been deemed quite indispensable, such as considerable gunshot fractures of the head of the humerus; a caries of the substance of this part, &c. Boucher in 1753, proved, that considerable wounds, extending into the shoulder-joint, might be successfully treated, by extracting the fragments and splinters of bone. (*Mém. de l'Acad. de Chir.* t. 2, p. 287 et 461.) Instances are also recorded, in which when the head and neck of the humerus in children had been totally disunited from the body of that bone, a cure was accomplished by making such incisions as allowed the portions of bone, now become extraneous bodies, to be taken away. The earliest case of this kind on record is that in which M. Thomas, a surgeon at Pezenas in Languedoc, removed the separated head of the humerus in 1740, which, in a child four years of age, presented itself loose in an incision, which had been previously made for the extraction of some sequestra. The particulars may be read in Guthrie's valuable work. (*On Gunshot Wounds*, p. 215, &c.) Mr. White, of Manchester, proceeded further, for he made a deep incision at the upper part of the arm, dislocated the head of the humerus, which he knew was carious, and, pushing it through the wound, took it off with a saw. He began an incision at the orifice of a sinus situated just below the processus acromion, and extended the wound down to the middle of the humerus by which all the subjacent bone was brought into view. He then took hold of the patient's elbow, and easily forcing the upper head of the humerus out of its socket, he brought it so entirely out of the wound, that he readily grasped it in his left hand, and held it there till he had sawn it off with a common amputation saw, having first applied a pasteboard card betwixt the bone and the skin. The patient did not lose more than two ounces of blood, only a small artery, which partly surrounded the joint, being wounded, which was easily secured.

In about five or six weeks, the part from which the bone had been taken, had acquired a considerable degree of firmness, and

the boy was able to lift a pretty heavy weight. At the end of two months, a large piece of the whole substance of the humerus was ready to separate from the sound bone, and with a pair of forceps it was easily removed. After this exfoliation the wound healed very fast; and, in four months after the operation, the boy was discharged perfectly cured. On comparing this arm with the other, it was not quite an inch shorter; the boy had the perfect use of it, and could not only elevate his arm to any height, but perform the rotary motion as well as ever. The figure of the arm was not at all altered. Mr. White did not make use of any splints, machine, or bandage, during the cure, in order to confine the limb strictly in one certain situation, nor was the patient's arm ever dressed in bed, but while he was sitting in a chair, and as soon as he could bear it standing up. To this method, Mr. White attributed the preservation of the motion of the joint.

"As this is the first operation of the kind that has been performed, or at least made public, (says Mr. White) I thought the relation of it might possibly conduce to the improvement of the art. That ingenious surgeon, Mr. Gooch, has indeed related three instances of the heads of bones being sawn off in compound luxations. In one of these cases, the lower heads of the tibia and fibula were sawn off, in another, that of the radius; and, in the third, that of the second bone of the thumb; but these were in many respects different from the present case. I believe it will seldom happen, that this operation will not be greatly preferable to amputation of the arm of the scapula, as this last is generally performed for a caries of the upper head of the os humeri, and as the preservation of a limb is always of the utmost consequence, and what every surgeon of the least humanity would at all times wish for, but particularly where, as in this case, the whole limb, and its actions, are preserved entire, the cure no ways protracted, and the danger of the operation most undoubtedly less. For though amputation is often indispensably necessary, and frequently attended with little danger or inconvenience when only part of a limb is removed, yet when the whole is lost, the danger is greatly increased, and the loss irreparable." Mr. White concludes, with suggesting an analogous operation for removing the head of the femur, in lieu of amputation at the hip. Something of this kind is indeed reported to have been actually done on a girl with success. (See *Joannis Mulder Oratio de Meritis P. Camperi*, &c. p. 81. *Cases in Surgery*, by C. White, p. 57. or *Phil. Trans.* Vol. 59. for 1769.)

Here, however, the acetabulum and ossa innominata being always, or generally, more diseased than the head of the femur, neither of these operations, I think, ought to be attempted. Long after the publication of White's case, viz. in 1767, an example, in which Vigaroux adopted the same practice, in 1788, was communicated to the profes-

sion: the result, however, was unfortunate, the patient, a lad seventeen years of age, having died soon after the experiment. (See *Œuvres de Chir. Prat. par I. M. I. Vigaroux (fils), Montp. 1812.*)

Bent, of Newcastle, has inserted a similar case to Mr. White's in the 64th vol. of the *Philosophical Transactions*. White made only one incision, from the vicinity of the acromion down to the middle of the arm. Bent, not being able to get at the head of the bone through the wound which he had made, from the clavicle to the attachment of the pectoral muscle, detached a portion of the deltoid, where it is connected with the clavicle, and another part, where it is adherent to the humerus. A third successful case is also reported in the 69th vol. of the same work, p. 6. Afterwards, Bromfield published some directions for the guidance of the surgeon in the execution of such operations. (*Chir. Obs. and Cases.*) Sabatier has proposed making two cuts at the upper part of the arm, which meet below like the letter V, extirpating the flap, dividing the inner head of the biceps, and capsular ligament; dislocating the head of the bone, and sawing it off. (*Médecine Opératoire, t. 3.*)

I think the cases recorded by White and Bent are truly important, inasmuch as they appear to have been the earliest models of a practice, which may sometimes supersede all occasion for one of the most formidable and mutilating operations of surgery. To military and naval surgeons, these cases cannot fail to be highly interesting, as they must have frequent opportunities of availing themselves of the instruction which they afford. Larrey, who was surgeon general to the French army in Egypt, employed the practice, with the greatest success in cases of gunshot wounds. He thereby saved limbs, which, according to ordinary precepts and opinions, would have been a just ground for amputating at the shoulder; and, when it is considered, not only that a most dangerous operation is avoided, but that an upper extremity is saved, for which no substitute can be applied, we must allow that the plan, first suggested and practised by Mr. White, cannot be too highly appreciated. When the arm was fractured near its upper extremity by a musket-ball, most surgeons formerly deemed it necessary to amputate the limb. Here, says Larrey, it would be useless to dilate the entrance and exit of the ball, because a sufficient opening could not be prudently made in this way for the extraction of the head of the bone. Yet this body is now an extraneous substance, having lost its connexion with the body of the humerus, and its presence exciting irritation and inflammation of the joint, abscesses, necrosis, &c. Here Larrey seems to imply, that the detached head of the bone cannot unite again; an assertion which, I have no doubt, is quite incorrect, as I have attended several cases in which the humerus was broken very high up, yet united without difficulty. The bad symptoms, which he so emphatically attributes to the detachment of

the head from the body of the bone, are in reality the effects of the gunshot violence itself. If, therefore, the head of the bone were merely broken off, and it and the neighbouring part of the bone not splintered, nor the flesh not more extensively injured than would arise from the passage of a musket-ball, and the joint itself not involved, I should question the propriety of having recourse, at once, either to the extraction of the head of the bone, or amputation at the shoulder. When the bone is shattered, the case is often very different, and Larrey's practice is then commendable. In confirmation of these sentiments, I may mention Mr. Guthrie's opinion, who, in reference to the extraction of the head of the bone, says, he does not consider a perfect fracture of the humerus, an inch below its head (although there be evident separation,) as demanding even this operation, as he has known such cases do well, when treated as other compound fractures, except that the motion of the joint was nearly lost. (*On Gunshot Wounds, p. 329.*) However, it is fair to mention, that Mr. Guthrie inclines to amputation at the shoulder when the body of the bone is splintered, or has long fissures in it, in which sentiment he is probably right. The other operation seems principally calculated for cases, in which the damage is restricted to the head and uppermost portion of the bone.

According to Mr. Guthrie, when the ball passes out with little injury to the bone, and the openings already made are not sufficient to admit of a moderate examination with the point of the finger, the wound should be enlarged. However, others might argue, that such dilatation should be made only when the bone is felt to be seriously broken, and the fragments will probably require immediate removal. But whatever course be adopted, the most rigorous antiphlogistic treatment will be proper; and, if abscesses form, depending openings should be made for the discharge.

Larrey says, "I have had the good fortune, on ten different occasions, to supersede the necessity for amputation at the shoulder, by the complete and immediate extraction of the head of the humerus, or its splinters, without delay. I perform the operation in the following manner: I make an incision in the centre of the deltoid muscle, and parallel to its fibres, carrying the incision as low down as possible. I get the edges of the wound drawn asunder, in order to lay bare the articulation, of which the capsule is generally opened by the first incision, and by means of a probe-pointed bistoury, I detach with the greatest ease from their insertions the tendons of the supra and infra spinati, of the teres minor, of the subscapularis, and of the long head of the biceps; then I disengage the head of the humerus, and remove it through the wound in the deltoid by means of my fingers, or of an elevator. I bring the humerus up to the shoulder, and fix it in a proper position with the aid of a sling and a bandage. Such is the ope-

ration, which I performed on ten patients, in extirpating the head of the humerus; one of these died of the hospital fever, two of the scurvy, at Alexandria, and the fourth, after he was cured, died of the plague on our return to Syria. The rest returned to France in good health. In some the arm became ankylosed to the shoulder, and in others, an artificial joint, allowing of motion, was formed." (See *Mém. de Chir. Militaire*, t. 2. p. 175.) Another successful case, of the same kind, has been more recently published by Mr. Morel. (See *Medico-Chirurg. Trans.* vol. 7. p. 161.)

Mr. Guthrie thinks it not sufficient to make a simple incision through the deltoid muscle into the capsular ligament, and take away the fragments of bone, but urges the removal at the same time of a considerable part of the capsular ligament, lest disease still go on in the joint. Also, as it is impossible to know, beforehand, in what state the bone may be below the fracture (that is, with respect to fissures running more or less down it,) he advises the incision, designed for the extraction of the splintered head of the bone, to be made in a situation where, if amputation at the joint be found indispensable, it will be of advantage. Mr. Guthrie likewise describes the manner of turning out the head of the bone in these cases, and sawing it off; the necessity of which, however, I do not clearly comprehend, unless the taking away of any sharp spicula of the upper end of the body of the bone be implied, which may be right. (*On Gunshot Wounds*, p. 333—335.) My ideas, however, chiefly extend to the removal of loose fragments, and splinters, and, with respect to sawing off the head of the bone, this is a proceeding, I suppose, necessarily limited to the kind of case reported by Mr. White.

AMPUTATION OF THE HEADS OF BONES.

In a letter, dated 1782, and addressed to Mr. Pott, Mr. Park, surgeon of the Liverpool Hospital, made the proposal of totally extirpating many diseased joints, by which the limbs might be preserved, with such a share of motion as to be of considerable use.

Mr. Park's scheme, in short, was to remove entirely the extremities of all the bones, which from the diseased joint, with the whole, or as much as possible, of the capsular ligament; and to obtain a cure by means of callus, or by uniting the femur to the tibia, when the operation was done on the knee; and the humerus to the radius and ulna, when it was done on the elbow; so as to have no moveable articulation in these situations.

To determine whether the popliteal vessels could be avoided, without much difficulty, in the excision of the knee, Mr. Park made an experiment on the dead subject. An incision was made, beginning about two inches above the upper end of the patella, and

extending about as far below its lower part. Another one was made across this at right angles, immediately above the patella down to the bone, and nearly half round the limb, the leg being in an extended state. The lower angles formed by these incisions were raised, so as to lay bare the capsular ligament; the patella was then taken out; the upper angles were raised, so as fairly to denude the head of the femur, and to allow a small catling to be passed across the posterior flat part of the bone, immediately above the condyles, care being taken to keep one of the flat sides of the point of the instrument quite close to the bone all the way. The catling being withdrawn, an elastic spatula was introduced in its place, to guard the soft parts, while the femur was sawn. The head of the bone thus separated, was carefully dissected out; the head of the tibia was then with ease turned out, and sawn off; and as much as possible of the capsular ligament dissected away, leaving only the posterior part covering the vessels, which, on examination, had been in very little danger of being wounded.

The next attempt was on the elbow; a simple longitudinal incision was made from about two inches above, to the same distance below, the point of the olecranon. The integuments having been raised, an attempt was made to divide the lateral ligaments, and dislocate the joint; but this being found difficult, the olecranon was sawn off, after which the joint could be easily dislocated, without any transverse incision, the lower extremity of the os humeri sawn off, and afterwards the heads of the radius and ulna. This appeared an easy work; but Mr. Park conceives the case will be difficult in a diseased state of the parts, and that a crucial incision would be requisite, as well as dividing the humerus above the condyles, in the way done with respect to the thigh bone.

Mr. Park first operated, July 2, 1781, on a strong, robust sailor, aged 33, who had a diseased knee, of ten years standing. The man's sufferings were daily increasing, and his health declining. Mr. Park, in the operation, wished to avoid making the transverse incision, thinking that after removing the patella, he could effect his object by the longitudinal one; but it was found that the difference between a healthy and diseased state of parts, deceived him in this expectation. Hence the idea was relinquished, and the transverse incision made. The operation was finished exactly as the one on the dead subject related above. The quantity of bone removed was very little more than two inches of the femur, and rather more than one inch of the tibia. The only artery divided was one on the front of the knee, and it ceased to bleed before the operation was concluded, but the ends of the bones bled very freely. In order to keep the redundant integuments from falling inwards, and the edges of the wounds in tolerable contact, a few sutures were used. The

dressings were light and superficial, and the limb was put in a tin case, sufficiently long to receive the whole of it, from the ankle to the insertion of the gluteus muscle.

I shall not follow Mr. Park throughout the treatment. Suffice it to remark, that the case gave him a great deal of trouble, and that it was attended with many embarrassing circumstances, arising chiefly from the difficulty of keeping the limb in a fixed position, the great depth of the wound, and the abscesses and sinuses, which formed in the part. On the other hand, however, the first symptoms were not at all dangerous. But, the patient was obliged to keep his bed nine or ten weeks, and it was many months more before the cure was complete. The man afterwards went to sea, and did his duty very well, so useful was his limb to him.

Subsequently to the publication of the letter to Mr. Pott, another excision of the knee was done by Mr. Park, on the 22d of June, but the event was unsuccessful, as the patient lingered till the 13th of October, and then died.

About the same time that Mr. Park made his proposal, P. F. Moreau, a French surgeon, wrote in favour of a similar method. It only seems necessary to notice here the difference in Moreau's plan of operating from that adopted by our countryman. Moreau, the son, who has published the account, observes, that the multiplicity of flaps is unnecessary, as two answer every purpose; and he deems Mr. Park's direction to remove the olecranon, if this be free from caries, at least useless. Moreau, junior, operated on the elbow as follows: with a dissecting scalpel he cut down to the sharp edge, or spine of the inner condyle of the os humeri, about two inches above its tuberosity; and directed by the spine, he carried the incision down to the joint. He did the same on the other side, and then connected the two wounds by a transverse incision, which divided the skin and the tendon of the triceps, immediately above the olecranon. The flap was dissected from the bone, and held up out of the way, by an assistant.

The flesh which adhered to the front of the bone, above the condyles, was now separated, care being taken to guide the point of the instrument with the fore-finger of the left-hand, and, when the handle of the scalpel could be passed through between the flesh and the bone, M. Moreau allowed it to remain there, and saved the bone through upon it. The removal of the piece of bone was next finished, by detaching it from all its adhesions. The removal of the heads of the radius and ulna, remaining to be done, was more difficult, and the first flap being insufficient, it became necessary to make another. The lateral incision, at the outer side of the arm, was extended downwards, along the external border of the upper part of the radius. The head of the radius was separated from the surrounding parts; its connexion with the ulna des-

troyed, and a strap of linen was introduced between the bones, in order to keep the flesh out of the way of the saw. The radius was sawn through, near the insertion of the biceps, which was fortunately preserved. Some remaining medullary cells, filled with pus, were removed with a gouge. The ulna was now exposed, by extending the lateral incision on the inner side of the arm. Thus another flap was made, and detached from the back part of the fore-arm, and that portion of the bone which it was wished to remove. The bone, being separated from every thing that adhered to it, and a strap of linen put round it to protect the flesh, about an inch and a half of it was sawn off, measuring from the tip of the olecranon downwards. A few diseased medullary cells were taken away with the gouge. Two or three vessels were tied, and the flaps were brought together with sutures. In a fortnight this man became so well, that he was allowed to go wherever he pleased, with his arm supported in a case. The arm was at first powerless, but it slowly regained its strength, and the man could ultimately thrash corn and hold the plough with it, &c.

Seven months after, another operation, performed in the same way as the preceding one, by Moreau the father, the patient was completely cured, and two years after this period, the flexion of the fore-arm on the arm, was very distinct. In another case, only one longitudinal incision, and a transverse one, were made, the flap being of course triangular. The patient got well in six weeks, and in three months more joined his regiment.

In all Moreau's cases, the flexion and extension of the fore-arm were preserved, which circumstance no doubt depended very much on the insertion of the biceps not being destroyed. After the excision of the knee, however, the bones grew together.

Moreau, junior's, method of operating differed from his father's, inasmuch as the patient was in a recumbent, instead of a sitting, posture, and the os humeri sawn before it was dislocated.

In a knee case, Moreau the father operated as follows:—He made a longitudinal incision on each side of the thigh, between the vasti and the flexors of the leg, down to the bone. These incisions began about two inches above the condyles of the femur, and were carried down along the sides of the joint, till they reached the tibia. They were united by a transverse cut, which passed below the patella, down to the bone.

The flap was raised; but the patella attached to it, being diseased, was dissected out. The limb was then bent so as to bring the condyles of the femur into view. As it was desired to cut them from the body of the bone, before dislocating them, every thing adhering to them behind, where they joined the body of the bone, was separated, and, at that place the fore-finger of the left-hand was passed through, in order to press back the flesh from the bone, while the saw was used. The knee having been

bent, Moreau drew the cut piece towards him, and easily detached it from the flesh and ligaments.

The head of the tibia was laid bare by an incision, nearly eighteen lines long, made on the spine of that bone. The first lateral incision on the outer side of the knee, was extended nearly as far down on the head of the fibula. Thus were obtained one flap, which adhered to the flesh filling up the interosseous space, and another triangular flap, formed of the skin, covering the inner surface of the tibia, which bone was of necessity exposed, before the saw could be applied.

Upon raising the outer flap, the head of the fibula came into view, and, after being separated from its attachments, was cut off with a small saw. The inner flap was then raised, and the head of the tibia, having been separated from the muscles behind, was sawn off.

It does not appear necessary to insert in this work the account of cutting out the ankle joint; an operation which will never be extensively adopted, nor shall I add any thing more concerning the mode of removing, in a similar way, the shoulder joint. In treating of amputation in this situation, I have already said enough, and whoever wishes for further information, respecting this practice, must refer to Dr. Jeffray's Work, entitled "*Cases of Excision of Curious Joints.*" This publication contains all that is known on the subject. Dr. Jeffray has recommended a particular, and, indeed, a very ingenious, saw, for facilitating the above operation. The saw alluded to is constructed with joints, like the chain of a watch, so as to allow itself to be drawn through behind a bone, by means of a crooked needle, like a thread, and to cut the bone from behind forward, without injuring the soft parts. An instrument of this kind was executed in London, by Mr. Richards, who was assisted in making it by his nephew, the present Mr. Richards of Bricklane. In placing the saw under a bone, its cutting edge is to be turned away from the flesh. Handles are afterwards hooked on the instrument.

According to my notions of the treatment of diseased joints, as long as the patient's strength is not subdued by the irritation of the local disease, humanity dictates the propriety of persevering in an attempt to save the affected limb, &c. Will a patient, greatly reduced by hectic symptoms, be able to recover from so bold and bloody an operation, as the dissection of the whole of the knee-joint out of the limb? If some few should escape, with life and limb preserved, would the bulk of persons, treated in this manner, have the same good fortune? I cannot admit, that the extirpation of the whole of so large an articulation as the knee, can be compared with the operation of amputation, in point of simplicity and safety. However, it is not on the difficulty of practising the former, that I would found my objections; for, I believe, that any man

possessing a tolerable knowledge of the anatomy of the leg, might contrive to achieve the business. The grounds, on which I withhold my approbation from the attempt to cut out large joints, are the following:—1. The great length of time which the healing of the wound requires. Whoever peruses the case of Hector M'Caghan, will find that the operation was performed on the 2d of July, 1781, and that it was February 28th of the following year, before all the subsequent abscesses and sores were perfectly healed. This space of time is very nearly eight months! Mr. Park describes the patient as a strong, robust sailor, and gives no further particulars concerning the state of his constitution, than that his health was declining. I entertain little doubt, that if the excision of the knee had been performed in that state of the health, in which amputation becomes truly indispensable, this man would not have survived the illness arising from the operation. The only other case, in which Mr. Park extirpated the knee, ended fatally. In the instance related by Moreau, there seemed, indeed, to be considerable debility. This patient escaped the first dangers consequent to so severe an operation; and, after three months confinement, the patient was in such a state, that Moreau expected he would be able to walk upon crutches in another month or six weeks! The young man in the mean time was attacked by an epidemic dysentery, and died. On the 21st of October, 1809, Mulder extirpated the knee-joint of a pregnant woman in the hospital at Groningen; but she died of tetanus on the 8th of the following February. He conceives, the operation is much facilitated by removing the ends of the femur and tibia in their connected state. (*See Diss. de Articulis extirpandis auctore G. H. Wachter.*) 2. Even supposing the excision of the knee to be followed by all possible success, is the advantage of having a mutilated, shortened, stiff limb, in lieu of a wooden leg, sufficiently great to induce any man to submit to an operation, beyond a doubt infinitely more dangerous than amputation? I think not. The practice is at present nearly exploded in this country; but, at Paris, I hear every now and then of its being attempted. Many interesting observations on the extirpation of various diseased joints, may be found in the above-mentioned dissertation by Wachter, and in the analysis of it by Langenbeck (*Bibl. für die Chir. B. 3, Göttingen, 1811.*)

In quitting this part of the subject, I may just notice, that an extraordinary case was communicated to me about two years ago by Mr. Dunn, of Scarborough, who cut out several of the tarsal bones, including the diseased surface of the astragalus, and also some of the metatarsal bones, from a boy's foot, with complete final success. The hemorrhage however was profuse, and great difficulty experienced in stopping it. Whether this bold experiment merits imitation, I am not at present prepared to say; but, be this as it may, the fact is interesting

AMPUTATION OF THE FINGERS AND TOES,
AND PART OF THE FOOT.

The best surgeons all agree with Mr. Sharp, that the amputation of the fingers and toes is most conveniently performed in their articulations. With a common scalpel, the skin is to be cut through circularly, not exactly upon the joint, but a little towards the extremity of the fingers, in order that a sufficient flap may be preserved for covering the end of the bone. On taking away a finger from a metacarpal bone, Mr. Sharp recommends making two small longitudinal incisions on each side of the joint, as a means of facilitating the separation.

In amputating the fingers and toes, the operation is greatly facilitated by cutting into the joint when it is bent. Having made an opening in the back part of the capsule, one of the lateral ligaments may easily be cut, after which nothing keeps the head of the bone from being turned out, and the surgeon has only to cut through the rest of the exposed ligamentous and tendinous parts.

Some recommend making a small semicircular flap of skin to cover the bone; but this is quite unnecessary, if care be taken to draw the skin a little up, and to cut where Mr. Sharpe directs. However, as making a small flap gives little pain, I have generally followed this method, though it appears to me nearly a matter of indifference which plan is adopted. In operating at the joints between the phalanges and metacarpal bones, a flap should always be made, either on the upper, or under part of the fingers to be removed.

Although it is generally best to remove the fingers at the joints, it is sometimes thought right, where the injury just includes the joint, and no more, to saw through the bone, instead of operating at the next articulation. (See *Guthrie on Gunshot Wounds*, p. 384.)

It may happen, that the bones of the toes, and only part of the metatarsal bones, are carious, in which case, the leg need not be cut off, but only so much of the foot as is disordered. A small spring saw is here the most convenient. When this operation is performed, the heel and the remainder of the foot will be of great service, and the wound heal up safely, of which Mr. S. Sharp says, he had in his time seen one example. (*Op. of Surgery*, Chap. 37, Ed. 3.) Mr. Hey confirms this statement of Sharp's concerning the impropriety of removing the whole foot, when the metatarsal bones are carious, and every other part of the leg is sound, as the remainder of the foot is of immense service in walking, the use of the ankle not being destroyed.

Mr. Hey describes a new mode of removing the metatarsal bones, which on repeated trial has answered his expectations. By the term *new*, I here mean a particular method, which had not been previously described, though it may have been performed by others before Mr. Hey himself; for the

merit of having first done it is imputed to the late Mr. Turner of North Yarmouth, who did it with success about the year 1787. (See *Hutchinson's Pract. Obs.* p. 70.) Mr. Hey makes a mark across the upper part of the foot, to denote where the metatarsal bones are joined to those of the tarsus. About half an inch from this mark, nearer the toes, he makes a transverse incision, through the integuments and muscles covering the metatarsal bones. From each extremity of this cut, he makes an incision along the inner and outer side of the foot to the toes: he removes all the toes from the metatarsal bones, and then separates the integuments and muscles, forming the sole of the foot, from the inferior part of the metatarsal bones, keeping the edge of the knife as near the bones as possible, in order to expedite the operation, and preserve as much muscular flesh in the flap as can be saved. He then separates the four smaller metatarsal bones, at their junction with the tarsus, and divides, with a saw, the projecting part of the first cuneiform bone, which supports the great toe. The arteries being tied, Mr. Hey applies the flap, which had formed the sole of the foot, to the integuments, which remain at the upper part, and keeps them in contact with sutures. The cicatrix being situated at the top of the foot, is in no danger of being hurt, while the place where the toes were situated, is covered with such strong skin, viz. what previously formed the sole of the foot, that it cannot be injured by any moderate violence. (See *Practical Observations in Surgery*, p. 535, &c.)

When the metatarsal bone of the great toe is alone diseased, Mr. Hey recommends dissecting it out from the cuneiform bone, instead of sawing it. The latter plan cannot be easily accomplished, without removing part of the integuments and muscles, and making a transverse, as well as a longitudinal, incision. These disagreeable things may be avoided by following the method of Mr. Hey, or of Mr. C. Bell. For removing the metatarsal bone, either of the little, or great toe, the latter gentleman directs us to carry a scalpel round the root of the toe, and then along the side of the foot. The flaps are then to be dissected back, the metatarsal bone is to be separated from the next; and its square head is to be detached from the tarsus. (*Operative Surgery*, Vol. 1. p. 390.)

The removal of the central metatarsal, and metacarpal bones, is an operation of much difficulty, and, the sawing of them is hardly practicable, without injuring the soft parts. Hence I am decidedly of opinion, with Mr. C. Bell, that, instead of a formal amputation, it is better to extract the diseased bones from the foot, or hand, as, indeed, Mr. Hey was in the habit of doing.

That skilful surgeon, Langenbeck, however, has devised a ready mode of taking away the middle finger, with its metacarpal bone, from the os magnum, or the ring finger, with its metacarpal bone, from the ar-

tication of the latter with the os magnum and os cuneiforme. In order to find out these articulations, he draws a line from the upper head of the metacarpal bone of the thumb straight across to the metacarpal bone of the finger to be extirpated, and, at this place, he begins his first incision, which runs towards each side of the finger, like an inverted V. The bone is then separated all round from the soft parts and dislocated from the carpus, when nothing remains to be done but to cut the parts towards the palm, where the wound is also made to resemble an inverted V, but does not extend any farther than is necessary to complete the separation. (See *Langenbeck's Bibl. B. 1, p. 575. and Plate 3, F. 1.*) This is unquestionably a simple and excellent method of operating, which Langenbeck also recommends as the best way of removing such bones of the metatarsus, as are not situated at the sides of the foot; care being taken to save a flap from the sole. It is often difficult, however, to know with certainty, whether the disease is confined to the metacarpal, or metatarsal bones; and, if it be not, and the carpus, or tarsus be affected, the operation will not answer, and amputation be indispensable. This happened in one of Langenbeck's cases, in which he had removed one of the metacarpal bones.

Modern surgeons never amputate the whole of the foot, or hand, when there is a reasonable chance of preserving any useful portion of it, though the rest may be most severely shattered. Thus, where a soldier had been struck by a grape shot, which shattered the metacarpal bones of the little and ring fingers, grazed the middle finger, and tore up the integuments on the palm and back of the hand, Mr. Guthrie succeeded in saving the two fingers and thumb, although, in the removal of the other parts, no regular flaps could be made for covering the wound. (*On Gunshot Wounds, p. 382.*) In winter campaigns, the toes, and more or less of the foot, are often attacked with mortification from cold. In this circumstance, when the disorder does not extend beyond the middle of the foot, or the toes, it is only necessary to cut away the gangrenous part. On the first entrance of the French army into Holland after the revolution, Paroisse met with many of these cases, in which it was necessary merely to take away the metatarsal bones, or sometimes those of the tarsus. All the patients, operated upon in this manner for the effects of cold, were cured; walking afterwards with more or less difficulty, according as the portion of the foot taken away had been greater or smaller. (*Opusculs de Chir. p. 218.*)

M. Roux, in his late publication, finds fault with our ignorance of Chopart's method of removing a part of the foot. He says, "I am certain, the principal surgeons in England, have never practised, and are even totally unacquainted with the amputation of the foot at the junction of the two

halves of the tarsus, or Chopart's operation." (*Voyage fait à Londres en 1814, on Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise, p. 338.*) As it is an operation of considerable merit, I think it will be useful to introduce a description of it in the present work. It is performed in the nearly parallel articulations of the os calcis with the os cuboides, and of the astragalus with the os naviculare. Thus the heel is preserved, on which the patient can afterwards walk. The performance of it is simple. The tourniquet having been applied, the surgeon is to make a transverse incision through the skin, which covers the instep, two inches from the ankle joint. He is to divide the skin, and the extensor tendons, and muscles, in that situation, so as to expose the convexity of the tarsus. He is next to make on each side a small longitudinal incision, which is to begin below and a little in front of the malleolus, and is to end at one of the extremities of the first incision. After having formed in this way a flap of integuments, he is to let it be drawn upward by the assistant who holds the leg. There is no occasion to dissect and reflect the flap; for the cellular substance connecting the skin with the subjacent aponeurosis is so loose, that it can easily be drawn up above the place, where the joint of the calcaneum with the cuboides, and of that between the astragalus and scaphoides ought to be opened. The surgeon will penetrate the last the most easily, particularly by taking for his guidance, the eminence, which indicates the attachment of the tibialis anticus muscle to the inside of the os naviculare. The joint of the os cuboides and os calcis lies pretty nearly in the same transverse line, but rather obliquely forward. The ligaments having been cut, the foot falls back. The bistoury is then to be put down, and the straight knife used, with which a flap of the soft parts is to be formed under the tarsus and metatarsus, long enough to admit of being applied to the naked bones so as entirely to cover them. It is to be maintained in this position with three or four strips of adhesive plaster, which are to extend from the heel, over the flap, to the inferior and anterior part of the leg.

Chopart used to tie every artery, as soon as it was divided. On the instep, the continuation of the anterior tibial artery will require a ligature; and, in the sole, the internal and external plantar arteries, in the thickness of the flap of soft parts, must generally be taken up. One half of each ligature is to be cut away, and the other one is to be left hanging out between the plasters, at the nearest and most convenient point.

Walther and Graefe have given some very precise directions for the performance of this operation. A cut is first made, beginning half an inch below the outer ankle, and extending forwards along the side of the foot two inches. Another similar incision is then made from one inch below the inner ankle. The foot is now to be bent up-

wards, and the two first cuts united by a transverse incision, two finger-breadths from the front of the tibia. A flap is then dissected up, as far back as the commencement of the lateral incisions, or a line corresponding to the articulation of the astragalus with the os naviculare, and of the os calcis with the os cuboides. An assistant now checks the bleeding by applying the points of his fingers on the mouths of such vessels as bleed profusely, and holds up the flap. The extremity of the foot is now to be firmly inclined downwards, so as to stretch the ligaments connecting the tarsal bones together. The ligaments between the astragalus and os naviculare are to be first cut, when the foot may be twisted somewhat outwards, and the ligaments between the os calcis and os cuboides divided. The division is lastly completed by cutting through the soft parts regularly from above downwards, with the precaution of directing the amputating knife so as to leave a flap composed of part of the sole of the foot. (See *Abhandl. aus dem Gebiete der Pract. Med. &c. Landshut*, 1810, B. 1, p. 152, & *Graefe Normen für die Abl. grosserer Gliedm.* p. 142.)

Sometimes, in consequence of the soft parts of the instep being all gangrenous or otherwise destroyed, it is necessary to make the flap entirely from the sole of the foot, as Klein was obliged to do in one of his cases. (*Practische Ansichten bedeutendsten Chir. Operationen.* H. 1, p. 28.) Indeed, Riche- rand thinks this mode generally advantageous, as the line of the cicatrix is not placed at the lower end of the stump, where it would be most exposed to injury. (*Nosogr. Chir.* T. 2, p. 502, &c. Ed. 4.) Langenbeck and Klein also condemn the painful and unnecessary measure of dissecting up a flap from the instep, as advised by Walther and Graefe. Chopart himself, as we have seen, merely drew back the integuments of the instep, without making any detachment of them from the subjacent parts. When the ends of the flexor tendons of the toes project too much from the inner surface of the lower flap, they are to be cut shorter, as Klein particularly directs; and I consider his advice not to use sutures for keeping the flap applied, but merely strips of sticking plaster, perfectly judicious. (*Op. cit.* p. 33-34.)

The following sources of instruction, on the subject of amputation, are particularly entitled to notice: *Celsus de Re Medicâ. Ouvres de Paré*, livre 12, chap. 30, & 33. *James Yonge, Currus Triumphalis é Terebintho*, 8vo. Lond. 1679. *R. Wiseman, Chir. Treatises*, 4to. Lond. 1692. *Sharp's Operations of Surgery*, chap. 37, and *Critical Inquiry into the present State of Surgery*, chap. 8. *Ravaton's Traité des Plaies d'Armes à Feu*, Paris, 1768. *Bertrandi, Traité des Opérations de Chirurgie*, chap. 23. *Le Dran's Obs. de Chir.* Paris, 1731, and his *Traité des Opérations de Chirurgie*, Paris, 1742, and the *English Translation with the additions of Cheselden*, by Gualaker, Lond. 1749. *Heister's Instit. Chirurg. Pars 2. Sect.*

1. *Nouvelle Méthode pour faire l'opération de l'Amputation dans l'Articulation du Bras avec l'Omoplate*, par M. De la Foye. P. H. Dahl. *Dis. de Humeri Amputatione ex Articulo*. Gott. 1760. *Histoire de l'Amputation, suivant la Méthode de Verduin et Sabourin, avec la Description d'un nouvel instrument pour cette Opération*, par M. De la Foye. P. H. F. Verduin, *Dis. Epistolaris de Nova Artuum decurtandorum Ratione*, 12mo. Amst. 1696. *Moyens de rendre plus simple et plus sûre l'Amputation à Lambeau*, par M. de Garregeot. *Observation sur la Resection de l'Os, après l'Amputation de la Cuisse*, par M. Veyret. *Mémoire sur la Saillie de l'Os après l'Amputation des Membres; où l'on examine les causes de cet inconvénient, les moyens d'y remédier, et ceux de la prévenir*, par M. Louis. *Second Mémoire sur l'Amputation des Grandes Extrémités*, par M. Louis. *The foregoing Essays are in Mém. de l'Acad. de Chirurgie*, Tom. 5, Edit. 12mo. R. de Vermale, *Obs. et Rémarques de Chirurgie pratique*; Mannheim, 1767. *Essai sur les Amputations dans les Articles*, par M. Brasdor, in T. 15, *Mém. de l'Acad. de Chir.* J. U. Bilguer *de Membrorum Amputatione rarissime administranda aut quasi abroganda*, 4to. Halle Magd. 1761. *White's Cases in Surgery*, 1770. *Bromfield's Chirurgical Observations and Cases*, Vol. 1. chap. 2. 8vo. 1773. *O'Halloran's complete Treatise on Gangrene, &c., with a new method of Amputation*, 8vo. Dub. 1765. *Alanson's Prac. Obs. on Amputation*, Ed. 2. 1782. J. L. Petit, *Traité des Maladies Chir.* T. 3, Paris, 1774, or the later Ed. 1790. R. Mynor's *Practical Thoughts on Amputation*, Birmingham. 1783. T. Kirkland, *Thoughts on Amputation*, &c. 8vo. Lond. 1780. Loder, *Comment. de Nova Alansonii, Amputationis Methodo*, Progr. 1. 7, Jen. 1784, or *Chir. Med. Beobachtungen*, 8vo. Weimar, 1794. J. F. Tscheppius, *Casus de Amputatione Femoris non Cruentâ*, Halle, 1742. (Haller *Disp. Chir.* 5, 239.) *Mursinna, Neue Med. Chir. Beobacht.* Berlin, 1796; P. F. Walther, *Abhandl. aus dem Gebiete der Prakt. Medicin, besonders der Chirurgie und Augenheilkunde*, B. 1, Landshut, 1810; Kern, *Ueber die Handlungsweise bey der Absetzung der Glieder*. Wien, 1814; G. Kloss, *De Amputatione Humeri ex Articulo*, 4to. Francof. 1811; W. W. Fraser, *an Essay on the Shoulder-joint Operation*, 8vo. Lond. 1813. H. Robbi, *De Via ac Ratione, qua olim membrorum Amputatio instituta est*, 4to. Lips. 1815. J. P. Roux, *Mémoire et Obs. sur la Réunion Immédiate de la Plaie après l'Amputation*, 8vo. Paris, 1814. J. G. Hauser, *Amputationis Ossium præcipua quædam momenta*. Lips. 1801. J. F. D. Evans, *Practical Observations on Cataract and closed Pupil, and on the Amputation of the Arm at the Shoulder, &c.* 8vo. Lond. 1815. H. J. Brunninghausen, *Erfahrungen und Bemerkungen über die Amputation*, 8vo. Bamb. 1818. Langenbeck, *Bibl. für die Chirurgie*, B. 1, p. 562, &c. 8vo. Gott. 1816. P. G. Van Hoorn, *De iis, quæ in partibus Membri, præsertim ossis, amputatione vulneratis notanda sunt*. 4to. Lugd. 1803. Graefe, *Nor-*

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AMY-LUM. Starch. Powdered starch is sometimes used as an external application to erysipelas; but, chiefly, in clysters, when the neck of the bladder is affected with spasm. The following is the formula used at St. Bartholomew's Hospital. R. *Mucilaginis Amyli, Aquæ distillatæ*: sing. Zij Tinct. Opii guttas quadraginta: Misce.

* ANASTOMOSIS, (from *ana*, through, and *stoma*, a mouth.) Anatomists and surgeons imply by this term, the communications of the blood-vessels with each other, or their running and opening into each other, by which the continuance of a free circulation of the blood is greatly ensured, and the danger of mortification lessened. The immense importance of this part of our structure, in all cases in which the main artery, or veins of a limb are obliterated, is

particularly conspicuous in the disease called aneurism. (See *Aneurism*.)

Nay, such has been the providence of nature in this respect, that, even where the thoracic aorta has been completely obstructed, the channels for the conveyance of the blood to the lower extremities have yet been found adequate to that purpose. This was proved in an example where the obstruction had been gradually produced by disease, and the anastomosing vessels of course had had time for enlargement; for, this is a very different case, from that in which a ligature is suddenly applied to the aorta; though, as far as can be deduced from the particulars of some experiments made on dogs by Mr. A. Cooper, and of one operation in which this gentleman tied the human abdominal aorta, (*Surgical Essays*, Part 1, p. 101,) blood will still pass to the lower extremities in sufficient quantity for their nutrition. At least, this inference is safely deducible from the very memorable operation to which I have referred, subject to one important condition, viz. that there be no additional cause of impediment to the passage of blood, to the lower extremities, besides the ligature above the bifurcation of the aorta. When Mr. A. Cooper tied the human aorta in the abdomen, the experiment was made as the only possible means of hindering a man from bleeding to death, who had a large aneurism of the external iliac artery actually beginning to bleed, and extending too high to admit of any thing else being done. Now, although the unfortunate patient was not saved, and it must be acknowledged that the chances of any other result were very small, the case furnished the important proof, that, if the abdominal aorta be suddenly and completely obstructed, the blood may yet pass in adequate quantity to the lower extremities, provided there exist no other cause of impediment to the passage of the blood into those members; for, on the side, occupied by the aneurism, the circulation in the limb was stopped, while, in the opposite limb, the circulation and natural warmth were preserved. To this subject, I shall hereafter return. (See *Aorta*.)

The changes which take place in the arterial system of the limb, when the main artery is rendered impervious by the application of a ligature, are well described by Mr. Hodgson: "The blood, meeting with an obstacle to its progress through the accustomed channel, is thrown in greater quantity, and with greater force, into those branches, which arise above the seat of the obstruction. The ramifications of these branches, in consequence of the unusual influx of blood, undergo a remarkable dilatation; the more minute vessels also, by which they anastomose with corresponding ramifications, arising from branches given off below the obstruction, are from the same cause sufficiently enlarged to allow a free passage of the blood into the inferior trunks of the limb. At first, the circulation

is in this manner carried on through a congeries of minute anastomosing arteries: in a short time, a few of these channels become more enlarged than the rest: as these increase in size, the smaller vessels gradually collapse, and ultimately a few large communications constitute permanent channels through which the blood is transmitted to the parts, that it is destined to supply. This is one mode by which a collateral circulation is established.

"But, in some situations, more direct and ostensible inosculation is provided; so that when one channel is obstructed, the blood passes at once through the other in a sufficient stream for the nourishment of the part, which it is destined to supply. Under these circumstances, no dilatation of the collateral branches is necessary: the circulation in such instances, may be said to be constantly carried on through inosculating trunks. These great communications principally exist in the extremities of the body, where the dilating impulse, which the blood receives from the heart, is of course diminished. Thus, the radial artery inosculates freely with the ulnar; the anterior with the posterior tibial; and the internal carotid with the vertebral arteries. Two modes therefore exist, by which arteries communicate with each other—the anastomoses of minute ramifications, and the direct inosculations of trunks." (See *Hodgson on the Diseases of Arteries and Veins*, p. 234.) Refer also to *Inosculation*. The best general account of the inosculations, in relation to aneurism, is contained in Scarpa's Treatise on Aneurism; more especially, the Italian edition, which is embellished with beautiful engravings.

ANCHYLOPS, (from *αγγι*, near, and *ωψ*, the eye.) Same as *Egylops*.

ANCHYLOSIS, (from *αγκυλος*, crooked.) This denotes an intimate union of two bones, which were naturally connected by a moveable kind of joint. All joints originally designed for motion, may become ankylosed, that is, the heads of the bones, forming them, may become so consolidated together, that no degree of motion whatever can take place. Bernard Conner (*De stupendo ossium coalitu*) describes an instance of a general ankylosis of all the bones of the human body. A still more curious fact is mentioned in the *Hist. of the Acad. of Sciences*, 1716, of a child 23 months old, affected with an universal ankylosis. In the advanced periods of life, ankylosis more readily occurs, than in the earlier parts of it. The author of the article *Ankylosis* in the *Encyclopédie Méthodique*, mentions his having preserved a specimen, in which the femur is so ankylosed with the tibia and patella, that both the compact and spongy substances of these bones appear to be common to them all, without the least perceptible line of separation between them. In old subjects, the same kind of union is commonly observable between the vertebrae, and between these and the heads of the ribs.

The greater, or lesser degree of immobility, has caused ankylosis to be distinguished into the *true* and *false*. In the true ankylosis, the bones have grown together so completely, that not the smallest degree of motion can take place, and the case is positively incurable. The position, in which the joint has become thus inalterably fixed, makes a material difference in the inconvenience resulting from the occurrence. The false ankylosis is that, in which the bones have not completely grown together, so that their motion is only diminished, not destroyed. The true ankylosis is sometimes termed *complete*; the false, *incomplete*.

In young subjects in particular, ankylosis is seldom an original affection, but generally the consequence of some other disease. It very often occurs after fractures, in the vicinity of joints; after sprains and dislocations attended with a great deal of contusion; and after white swellings and abscesses in joints. Aneurisms, and swellings and abscesses on the outside of a joint, may also induce ankylosis. In short, every thing which keeps a joint long motionless may give rise to the affection, which is generally the more complete the longer such causes have operated.

When a bone is fractured near a joint, the limb is kept motionless by the apparatus, during the whole time requisite for uniting the bones. The subsequent inflammation also extends to the articulation, and attacks the ligaments and surrounding parts. Sometimes, these only become more thickened and rigid: on other occasions, the inflammation produces a mutual adhesion of the articular surfaces. Hence fractures so situated, are more serious, than when they occur at the middle part of a bone. Though common fractures leave, after their cure, a certain degree of stiffness in the adjacent joints, this is different from true ankylosis; it merely arises from the inactivity, in which the muscles and articular surfaces have been kept for a time, and may generally be cured by gradually exercising, and increasing the motion of the limb.

The position of an ankylosed limb is a thing of great importance. When abscesses form near the joints of the fingers, and the tendons mortify, the fingers should be bent, that they may ankylose in that position, which renders the hand much more useful, than if the fingers were permanently extended. On the contrary, when there is danger of ankylosis, the knee should always be kept as straight as possible. The same plan is to be pursued, when the head of the thigh bone is dislocated in consequence of a diseased hip. When the elbow cannot be prevented from becoming ankylosed, the joint should always be kept bent. No attempt should ever be made to cure, though every possible exertion should often be made to prevent, a true ankylosis. The attempt to prevent, however, is not always proper, for many diseases of joints.

may be said to terminate, when ankylosis occurs.

When the false, or incomplete ankylosis is apprehended, measures should be taken to avert it. The limb is to be moved as much as the state of the soft parts will allow. Boyer remarks, that this precaution is much more necessary in affections of the ginglymoid articulations, than of the orbicular ones, on account of the tendency of the former to become ankylosed, by reason of the great extent of their surfaces, the number of their ligaments, and the naturally limited degree of their motion.

The exercise of the joint promotes the secretion of the synovia, and the grating first perceived in consequence of the deficiency of this fluid soon ceases. A certain caution is necessary in moving the limb: too violent motion might create pain, swelling, and inflammation, and even caries of the heads of the bones. It is by proportioning it to the state of the limb, and increasing its extent daily, as the soft parts yield and grow supple, that good effects may be derived from it. (See *Boyer Mal. des Os*, Tom. 2.) The use of embrocations, and pumping cold water on the joint, every morning, have great power in removing the stiffness of a limb remaining after the cure of fractures, dislocations, &c.

Unreduced dislocations are not always followed by ankylosis. Nature often forms a new joint, especially in persons of the lower order, who are obliged to move their limbs a great deal, in order to obtain a livelihood. The surrounding cellular substance becomes condensed, so as to form, around the head of the luxated bone, a membrane serving the purpose of a capsular ligament. The muscles, at first impeded in their action, become so habituated to their new state, that they resume their functions. This is particularly the case with bones which move in every direction, and have round heads; but, in ginglymoid joints, the heads of the bones are only imperfectly dislocated, and the motion is greatly restrained by the extent of surface; while some of the numerous ligaments are only sprained, not ruptured. These causes promote the occurrence of ankylosis.

Ankylosis may follow contusions of the joints, and such shocks, as the articular surfaces experience in leaping, or falling on the feet, from great heights. This is more likely to happen, when the inflammatory symptoms, resulting from such violence, have not been properly counteracted by bleeding, and other general remedies. Sprains, which violently twist the joints, very often on this account, cause an ankylosis, especially when the inflammation has long hindered such joints from being at all moved.

When diseases of joints end in a complete ankylosis, the occurrence is to be looked upon as a very favourable one. In fact, it is as much a means of cure, as the formation of callus is for the union of broken bones. The disease of the vertebrae,

described by Pott, is cured as soon as the bones ankylose, nor can the patient be considered well, before this event has taken place. *W.H. Müller de Anchylosi*, Lugd. 1707. *L'Encyclopédie Méthodique, Partie Chirurgicale, Tom. 1. art. Anchylose. J. L. Petit, Traité des Mal. d'Os. T. 2. J. T. van de Wymperse, de Anchyloseos Pathologia and Curatione, singularibus observationibus et fig. ill 4to. Lugd. 1763. Gentleman's Magazine, 1787, universal ankylosis, ligaments ossified; Wurcz, Wundarzn. p. 224, following the removal of the patella; Sandifort Exercit. Acad. p. 1. &c., ankylosis of the occiput with the atlas, and of the atlas with the dentatus; Sandifort, Obs. Pathol. ankylosis of the jaw. Dumas, *Récueil Périodique de la Société de Med. T. 10, p.30, and t. 13. p.352. Henmen's Principles of Military Surgery, p. 161, &c. Ed. 2. The examples of general ankylosis are numerous: Plouquet refers to Columbus de Re Anatomicâ; Connor de stupendo Ossium coalitu, Oxon. 1695; Deslandes in Mém. de l'Acad. des Sciences, 1716; Frank, Reinsnach, Paris, Mondon, &c., p. 127, ankylosis of all the joints except those of the lower jaw; Olivier, in Journ. de Med. T. 12, p. 274; Voigt Mag, für den Neuesten Zustand der Naturkuden, 4 B. p. 412; Portal, Cours d'Anat. Méd. T. 1, p. 14; Phil. Trans. No. 461; J. C. Smith, Nat. Hist. Hiberniæ Comit. 1744. Job a Meckren's Obs. C. 64, p. 297. Collisen's Systema Chir. Hodiernæ, T. 2. p. 699. edit. 1800. Boyer Mal. des Os, Tom. 2, et Traité des Maladies Chirurgicales, T. 4. p. 543. Verduc Traité des Bandages, chap. 35, p. 172. Richerand's Nosogr. Chir T. 3. p. 223, edit. 4.**

* ANEURISM, or ANEURYSM, (from *aneurysma*, to dilate.) The tumours which are formed by a preternatural dilatation of a part of an artery, as well as those swellings, which are occasioned by a collection of arterial blood, effused in the cellular membrane, in consequence of a rupture, or wound of the coats of the artery, receive the name of aneurisms. According to these opinions, aneurisms are of two kinds; the first being termed *true*, the second *spurious*, or *false*. Some modern writers have ventured to reckon another form of aneurism, which is said to happen, when the external coats of an artery being weakened by mechanical injury, or disease, the internal coat protrudes through the breach in the outer coat, so as to form a tumour distended with blood. This case has been denominated the *internal mixed aneurisms*, or *aneurisma herniam arteriæ sistens*. The reality of this form of disease was believed by Dr. W. Hunter; and some delicate experiments, instituted by Haller on the mesenteric arteries of frogs, appear to have been the first ground of the opinion. Such an aneurism, however, has not been universally admitted, not that any body doubted the correctness of what Haller advanced, but because there might not always be a perfect analogy between the results of an experiment on animals, and those afforded by the observation of the diseases of the human body.

When Haller asserted, that, by separating the muscular from the inner coat of the arteries, he could, when he pleased, produce an aneurism in these animals; and when Hunter declared, that such an experiment made the artery firmer than ever, in consequence of the adhesive inflammation taking place; the character and veracity of these eminent men naturally lead to the question, whether the experiments were conducted exactly in the same manner. Now, says Mr. Wilson, when we know, that Haller did not suffer the surrounding parts to unite, and that John Hunter did, we can no longer be at a loss to account for the different conclusions. (See *Wilson's Anatomy, Pathology, &c. of the Vascular System*, p. 378.)

However this may be with respect to the experiments made on certain animals, I am disposed to consider it fully proved by Mr. J. Hunter, Sir. E. Home, and Professor Scarpa, that in the human subject, an aneurism will not arise from the kind of weakness, which is caused by cutting or even stripping off the external coat of a sound artery, whether the wound be closed or not.

This fact would at least appear to be well established, with respect to the generality of the arteries; but, how far it is so in relation to the aorta, is another question, the inner membrane of which vessel is alleged to be more elastic than that of common arteries. Dubois and Dupuytren, in fact, are stated to have presented to the Faculty of Medicine at Paris preparations, which exhibit the lining of the aorta protruding through the middle coat, in form of a sac filled with blood. (See *Dict. des Sciences Méd. art. Aneurisme*, and *Breschet in Trans. of Mr. Hodgson's work*, p. 130.)

By the term *mixed aneurism*, Dr. A. Monro, senior, implied the state of a true aneurism, when its cyst had burst, and the blood was diffused in the adjacent cellular substance; an event which is frequent. Besides these varieties of aneurism, the *aneurismal varix*, or *venous aneurism*, and the *aneurism from anastomosis*, constitute diseases which are usually regarded as cases pertaining to the present subject, though incapable of being comprised under the ordinary definition of an aneurism.

Nothing can be more manifest, than the fact, that, previously to the discovery of the circulation of the blood, no correct, nor valuable opinions could have prevailed, respecting the diseases, which now go under the name of aneurisms. Indeed, it was not until after the days of Aristotle, that any distinction was made between the swellings of veins and those of arteries, such vessels not having been at that early period distinguished from each other. Their differences were first pointed out by Rufus of Ephesus. (*Et. Tertab. 4, Serm. 2. c. 51, col. 716.*)

Down to Galen, however, nothing like consistency was established in the notions respecting aneurism. His opinion was, that all tumours of this nature were produced either

by anastomosis, or by rupture, and though he has described their symptoms, he has not informed us of the characters by which each of these cases was distinguishable, one from the other. Paulus Ægineta divides aneurism into two sorts, both of which he says are attended with extravasation, and of course with rupture.

Vesalius, who first applied anatomy to the investigation of disease, has described an aneurism arising from the *rupture of a dilated aorta*; the first specimen, I believe, on record of this form of disease. (*Bonetus Sepulch. Anat. lib. 4. Sect. 2.*)

The combination of rupture with dilatation of the artery, was afterwards more particularly noticed by Nuck. (*Oper. Chir. &c. Lugd. 1692.*)

It was Fernelius who first promulgated the doctrine, that aneurisms were always dilated arteries. (*Universa Medicina, De Extern. Corp. Affect. lib. 7. cap. 3, Venet. 1564.*)

This opinion was espoused by Forrester, Diemerbroeck, and others; but at length, the inaccuracy of attempting to refer every aneurism solely to dilatation of the coats of the vessel, was established by the observations of Lancisi, Friend, Guattani, and Morgagni. In short, as Mr. Hodgson has stated, these authors proved, that aneurism may be produced either by the rupture, or the dilatation of the coats of an artery, or by a combination of both circumstances, the dilatation having preceded the rupture. (*On the Diseases of Arteries, &c. 8vo. Lond. 1815.*)

This admission of aneurism by dilatation, and of aneurism by rupture of the coats of an artery, together with the frequent combination of both circumstances, was indeed the prevailing undisturbed doctrine of every surgical school, until Professor Scarpa, inclining to the tenets of Sylvaticus (*De Aneurymate. Tract. Venetiis, 1600, 4to.*) ventured to question the correctness of the common opinion about the dilatation of all the arterial coats. However, after the very clear and satisfactory elucidation of this disputed point by my friend Mr. Hodgson, the accurate views of the first subject, taken by Morgagni, and the other eminent writers specified above, may be regarded as established beyond the possibility of dispute. At the same time, it is not to be supposed, that Scarpa means to say, that the arteries are not subject to a morbid dilatation; on the contrary, he gives a particular description of this affection, which he carefully discriminates from aneurism.

Previously to offering a more particular account of the doctrine taught by Scarpa, respecting the formation of aneurism, as well as of the chief facts, which may be adduced against a part of such doctrine, it seems proper to make the reader acquainted with the various species of the disease, their ordinary symptoms, and a few other circumstances.

When any part of an artery is dilated, (at-

tended with particular circumstances, marking its difference from another form of dilatation, which, as I shall explain, perhaps ought not to be set down as aneurismal,) the swelling is commonly named a *true*, or *genuine aneurism*. In such cases, the artery is either enlarged at only a small part of its track, and the tumour has a determinate border, or the vessel is dilated for a considerable length, in which circumstance the swelling is oblong, and loses itself so gradually in the surrounding parts, that its margin cannot be exactly ascertained. The first case, which is the most common, is termed the *circumscribed true aneurism*; the last, the *diffused true aneurism*; a case, however, which would be looked upon by Scarpa only as a specimen of dilatation, different in several particulars from aneurism, as will be hereafter noticed. When blood escapes from a wound, or rupture, of an artery, into the adjoining cellular substance, the swelling is denominated the *spurious*, or *false aneurism*. In this instance, the blood either collects in one mass, distends the cellular substance, and condenses it into a cyst, so as to form a distinctly circumscribed tumour; or it is injected into all the cavities of the surrounding cellular substance, and extends along the course of the great vessels, from one end of the limb to the other, thus producing an irregular, oblong swelling. The first case is named the *circumscribed false aneurism*; the second, the *diffused false aneurism*. (*Richer's Anfangsgr. B. 1.*)

These appellations are in my opinion preferable to the term *cylindrical*, applied by Sauvages to true aneurisms, or *sacciform*, proposed by Morgagni for false aneurisms. (*Advers. Anat. 2, Aortæ Animadv. 38, et Epist. Anat. 17, No. 27.*) Because, as we shall see in the course of this article, though true aneurisms (including dilatations of all the arterial coats of every kind,) do mostly affect the whole circumference of the vessel, and must therefore partake of a cylindrical shape, there are exceptions, in which a distinct circumscribed sac, composed of all the coats of the vessel, projects from one side of an artery, the diameter of which may not be at all increased. Here the disease might rather be named *sacciform*, the very appellation suggested by Morgagni for false aneurisms, in which the disease generally originates in this shape, from whatever particular side of the vessel the inner coats have given way. We see also that the subject actually demands more numerous distinctions, since aneurisms undergo in their progress various changes, which sometimes make an immense, and even a very sudden difference in their shape, cases which were at first circumscribed, afterwards becoming diffused.

The symptoms of the circumscribed true aneurism take place as follows: The first thing the patient perceives is an extraordinary throbbing in some particular situation, and, on paying a little more attention, he discovers there a small pulsating tumour,

which entirely disappears when compressed, but returns again as soon as the pressure is removed. It is commonly unattended with pain, or change in the colour of the skin. When once the tumour has originated, it continually grows larger, and, at length, attains a very considerable size. In proportion as it becomes larger, its pulsations become weaker, and, indeed, they are almost quite lost, when the disease has acquired much magnitude. The diminution of the pulsation has been ascribed to the coats of the artery losing their dilatable and elastic quality, in proportion as they are distended and indurated, and, consequently, the aneurismal sac being no longer capable of an alternate diastole and systole from the action of the heart. The fact is also imputed to the lamellated coagulated blood, deposited on the inner surface of the sac, particularly in large aneurisms, in which some of the blood is always interrupted in its motion. Immediately, such coagulated blood lodges in the sac, pressure can only produce a partial disappearance of the swelling. This deposition of lamellated coagulum in the aneurismal sac is a circumstance of considerable importance; for, it has been well explained by Mr. Hodgson, that it is the mode by which the spontaneous cure of the disease is in most instances effected. "One of the circumstances, which, in the most early stage, generally attend the formation of aneurism (says this author,) is the establishment of that process, which is the basis of its future cure. The blood, which enters the sac soon after its formation, generally leaves upon its internal surface a stratum of coagulum, and successive depositions of the fibrous part of the blood gradually diminish the cavity of the tumour. At length the sac becomes entirely filled with this substance, and the deposition of it generally continues in the artery, which supplies the disease, forming a firm plug of coagulum, which extends on both sides of the sac to the next important ramifications that are given off from the artery. The circulation through the vessel is thus prevented, the blood is conveyed by collateral channels, and another process is instituted, whereby the bulk of the tumour is removed, &c." (*On the Diseases of Arteries, &c. p. 114.*) Whether there is any truth in Kreysig's conjecture, that some of the lymph may exude from the inside of the sac itself, I cannot pretend to say. He owns, however, that the inner concentric layers presenting the appearance of being deposited last, is a circumstance rather against his surmise, though he adverts to some other circumstances which incline him to look upon the opinion as possibly correct. (*German Transl. of Mr. Hodgson's Work, p. 124.*)

In a preceding paragraph, I have spoken of the diastole and systole of the aneurismal sac; for, it is the general belief, that the pulsation of the tumour is produced by the jet of blood into it at each stroke of the heart. This opinion, however, is disputed by an eminent writer, who asks, Is it

true, that the pulsation of aneurisms proceeds from the entrance of a more considerable stream of blood into the sac, and the distention of the swelling thereby produced? In aneurisms, which have only a narrow communication with the arterial tube, or which are filled with laminated coagula, the idea, says he, is quite inadmissible: the aneurism is rather shaken, as it were, like other different swellings in the vicinity of an artery, by the stroke of the heart occasioning a stretching of the whole arterial system, and at the same time communicating an impulse to the column of blood. (*Kreysig, Germ. Tr. of Mr. Hodgson's Work, p. 143.*) Here, however, I am by no means disposed to coincide with this distinguished physician, whose sentiments appear to me to be refuted by the fact, that, whenever any change happens, calculated to lessen or entirely stop the influx of blood into the sac, the pulsation either diminishes, or ceases in proportion. Thus, when Kreysig adverted to the pulsation of aneurisms, in which much coagulated blood was deposited, he might at the same time have mentioned the effect, which such deposition has in weakening the pulsation, the layers of coagulated blood within the tumour being in the natural mode of cure, as Mr. Hodgson has correctly explained, "the means by which the force of the circulation is removed from the sac, and the fatal termination of the disease by rupture is prevented." (*On Diseases of Art. and Veins, p. 126.*) In proportion as the aneurismal sac grows larger, the communication of blood into the artery beyond the tumour is lessened. Hence, in this state, the pulse, below the swelling, becomes weak and small, and the limb frequently cold, and oedematous. On dissection, the lower continuation of the artery is found preternaturally small and contracted. The pressure of the tumour on the adjacent parts may also produce a variety of symptoms, ulceration, caries, &c. Sometimes (says Richter,) an accidental contusion, or concussion, may detach a piece of coagulum from the inner surface of the cyst, and the circulation through the sac be obstructed by it: nay, he asserts, that the coagulum may possibly be impelled quite into the artery below, so as to induce important changes. The danger of an aneurism arrives when it is on the point of bursting, by which occurrence the patient usually bleeds to death, and this sometimes in a few seconds. The fatal event may generally be foreseen, as the part about to give way becomes particularly tense, elevated, thin, soft, and of a dark purple colour. (*Richter's Anfangsgr. Band. 1.*)

A large axillary aneurism, which burst in St. Bartholomew's Hospital some years ago, did not burst by ulceration, but, by the detachment of a small slough from a conical, discoloured part of the tumour; and soon after this case fell under my observation, I had an opportunity of seeing the process, by which an inguinal aneurism burst: at a certain point, the tumour became more con-

cal, thin, and inflamed, and here a slough, about an inch in width, was formed. On the dead part becoming loose, a profuse bleeding began, which was stopped for a short time by pressure, but soon returned with increasing violence, and put an end to the patient's misery. We are then to conclude, that external aneurisms do not burst by ulceration, but by the formation and detachment of a slough. I believe this is a fact, which was first particularly pointed out in the early editions of my work, and it gives me pleasure to find, that it is a statement which entirely coincides with that subsequently made by several writers of eminence, especially Mr. A. Burns (*On Diseases of the Heart, p. 225.*) and Boyer (*Traité des Maladies Chirurgicales, T. 2, p. 98.*)

As far as my information extends, Mr. A. Burns first explained the very different mode of rupture which happens in internal aneurisms; these, he observed, generally burst by actual laceration, and not by sphacelation of the cyst. (*On Diseases of the Heart, p. 225.*) But a still more particular account of the process, by which external and internal aneurisms burst, is delivered by Mr. Hodgson. When the sac points externally, (says this gentleman,) it rarely or never bursts by laceration, but the extreme distention causes the integuments and investing parts to slough, and upon the separation of the eschar, the blood issues from the tumour. A similar process takes place, when the disease extends into a cavity, which is lined by a mucous membrane, as the œsophagus, intestines, bladder, &c. In such cases, the cavity of the aneurism is generally exposed by the separation of a slough, which has formed upon its most distended part, and not by laceration. But, when the sac projects into a cavity lined by a serous membrane, as the pleura, the peritoneum, the pericardium, &c. sloughing of these membranes does not take place, but, the parietes of the tumour having become extremely thin in consequence of distention, at length burst by a crack, or fissure, through which the blood is discharged. (*On the Diseases of Arteries, &c. p. 85.*)

When the aneurism is of considerable size, the collateral arteries, which originate above the swelling, are manifestly enlarged. Boyer informs us, that, in dissecting the lower extremity of a patient, on whom Desault had operated eight months previously for a popliteal aneurism, he found in the substance of the great sciatic nerve an artery, whose diameter was equal to that of the radial at the wrist. This vessel had its origin from the ischiatic artery, and descended to the back part of the knee, where it anastomosed with the upper articular arteries. Boyer had also noticed in the same subject before the operation, that one of the branches of the upper internal articular artery was so much enlarged, that its pulsation could be plainly felt on the internal condyle of the thigh-bone. (*Op. cit. p. 93.*) It is such enlargement of the collateral arteries above the disease, which en-

tures to the limb below the tumour an adequate supply of blood when the obstruction to its passage through the diseased artery becomes considerable, or when this vessel has been rendered totally impervious by a surgical operation performed for the cure of the complaint.

In the advanced stage of an aneurism, the skin is found extremely thin, and confluent, as it were, with the aneurismal sac. The cavities of the cellular substance near the disease are either filled with serum or totally obliterated by adhesion. The adjacent muscles, whether they lie over the aneurism, or to one side of it, are stretched, displaced, dwindled, and sometimes confluent with other parts. It is the same with the large nervous cords situated at the circumference of the tumour: they are pushed out of their natural situation, diminished in size, sometimes adherent to the outside of the sac, and so changed as scarcely to admit of being known again. Lastly, the cartilages and the bones themselves are not exempt from the mischief which the aneurismal swelling produces in all the surrounding parts: they are gradually destroyed, and, at length, not the least trace of their substance remains, just in the same way as the bones of the cranium are destroyed by fungous tumours of the dura mater. (See *Dura Mater*.) Even the cartilages of the larynx, and rings of the trachea, are sometimes destroyed; this tube is pierced, and the blood escapes into it, or the aneurism bursts into the œsophagus. (*Boyer, Traité des Maladies Chirurgicales*, T. 2, l. 99.) As I shall hereafter explain, however, the pressure of an aneurismal tumour more quickly produces an absorption of bone, than of cartilage.

While an aneurism is small and recent, it does not generally cause much pain, nor seriously impede the functions of the limb. But, when it has increased, several complications are produced. Thus, the dragging of the saphenous nerve, by femoral aneurisms, frequently occasions acute pain in the course of this nerve as far as the great toe. The distention of the sciatic nerve by the popliteal aneurism, sometimes brings on intolerable pain, which extends to all the parts to which this nerve is distributed, and which can hardly ever be appeased by the topical use of opiate applications. The compression of the veins and lymphatics gives rise to œdema, numbness, and coldness of the limb. And, finally, the long-continued pressure of the aneurism on the neighbouring bones causes their destruction. (*Boyer, p. 105, T. 2.*)

In cases of true aneurism, the coats of the artery are not always in the same state, the kind of changes observed depending upon the progress of the tumour. In the early stage of the disease, either the whole cylinder of the vessel, or only a part of its circumference, is dilated; but, this period is generally of short duration, especially in arteries of middling size, because their middle coat is capable of less resistance, than

that of the larger arteries, like the aorta, where this coat is yellowish, firm, and very elastic. As Breschet remarks, this difference of resistance in the middle coat of the aorta, and the branches given off from it, accounts for the rarity of true aneurisms either in the small arteries, or those of middling size, and their greater frequency in the principal trunk of the arterial system.

At length, in consequence of the increasing distention, some of the coats of the artery, possessing the least elasticity, give way, and these are found to be the internal and middle coats, while the external one still makes resistance, and continues to be more and more dilated by the lateral impulse of the blood.

The second stage of true aneurism, is that which is mostly met with, that, in which the tumour increases more rapidly, and therefore begins to excite greater attention. The disease, when it has attained this form, is in point of fact no longer a true aneurism; but a case which Mouro distinguished by the name of the *consecutive*, or *external mixed false aneurism*. In this stage, the patient's life is endangered, and death often brought on by the rupture of the tumour. Examinations of the dead subject, under these circumstances, have frequently led to mistaken notions, and, doubtless, if various swellings of this kind had not been found in different degrees, or stages, in the same individual, one might be disposed to join Scarpa in the belief, that no aneurism consists of dilatation of all the arterial coats. (*Breschet, Fr. Transl. of Mr. Hodgson's work, p. 128, 129.*)

The *false aneurism* is always attended with at least a rupture, or giving way of the inner coat of the vessel, and usually with a breach in both this and the muscular coat, the outer elastic tunic forming the pouch in which the blood collects. But, after the swelling has attained a certain size, this coat also bursts, and then the blood either becomes diffused, or a large circumscribed space is formed for it by the condensation of the surrounding cellular membrane. False aneurisms, when produced by a wound, or puncture, are of course from the first attended with a division of all the coats of the vessel. This form of the disease is often seen at the bend of the arm, where the artery is exposed to injury in venesection. (See *Hemorrhage*.) In this circumstance, as soon as the puncture is made, the blood gushes out with unusual force, and in a bright scarlet, irregular, interrupted current; flowing out, however, in an even, and less rapid stream, when pressure is applied higher up, than the wound. These last are the most decisive marks of the artery being opened; for blood may issue from a vein with great rapidity, and in a broken current, when the vessel is turgid, and situated immediately over the artery, which imparts its motion to it. The surgeon endeavours precipitately to stop the hemorrhage by pressure, and in general a *diffused false aneurism* is the result. The external wound

in the skin is closed, so that the blood cannot escape; but, this does not hinder it from passing into the cellular substance. The swelling, thus produced, is uneven, often knotty, and extends upward and downward along the track of the vessel. The skin is also usually of a dark purple colour. Its size increases, as long as the internal hemorrhage continues, and, if this should proceed beyond certain bounds, mortification of the limb ensues. Such is the *diffused false aneurism* from a wound.

The *circumscribed false aneurism*, from a wound, or puncture, arises in the following manner. When proper pressure has been made in the first instance, so as to suppress the hemorrhage; but, the bandage has afterwards been removed too soon, or before the artery has healed, the blood passes through the unclosed wound, or that which it has burst open again, into the cellular substance. As this has now become agglutinated by the preceding pressure, the blood cannot diffuse itself into its cells, and, consequently, a mass of it collects in the vicinity of the aperture of the artery, and distends the cellular substance into the form of a sac. Sometimes, though not often, this circumscribed false aneurism, originates immediately after the opening is made in the artery. This chiefly happens when the aperture in the vessel is exceedingly small, and, consequently, when the hemorrhage takes place so slowly, that the blood, which is first diffused, coagulates, and prevents the entrance of that which follows into the cavities of the cellular substance, and of course, its diffusion. False aneurisms, proceeding from the rupture of the inner coats of an artery, are always at first circumscribed by the resistance of the outer tunic.

The circumscribed false aneurism consists of a sac, composed of the external coat of the artery, or, in case this has given way, it is composed of an artificial pouch, formed among whatever parts happen to be in the vicinity of the burst artery. This cavity is filled with blood, and situated close to the artery, with which it has a communication. Hence, in false aneurisms, a throbbing is always perceptible, and is more manifest, the smaller such tumours are. The larger the sac becomes, the less elastic it is, and the greater is the quantity of laminated coagula in it; so that in very large aneurisms of this kind, the pulsation is sometimes wholly lost.

The tumour is at first small, and on compression entirely disappears; but, returns as soon as this is removed. It also diminishes, when the artery above it is compressed, but, resumes its wonted magnitude, immediately such pressure is discontinued. When there is coagulated blood in the sac, pressure is no longer capable of producing a total disappearance of the tumour, which is now hard. The swelling is not painful, and the integuments are not changed in colour. It continually increases in size, and, at length, attains a prodigious magnitude.

The following are generally enumerated,

as the discriminating differences between circumscribed true and false aneurisms: the true aneurism readily yields to pressure, and as readily recurs on its removal; the false one yields very gradually, and returns in the same way; and, as it contains laminated coagula, it cannot be reduced in the same degree by compression, as an aneurism formed by a dilatation of the arterial coats, where such strata of coagulated blood are usually absent. Frequently, a hissing sound is audible, when the blood gushes into the sac. The pulsation of the false aneurism is always more feeble, and, as the tumour enlarges, is sooner lost, than that of the true one, which throbs after it has acquired a considerable volume. (See *Richter's Anfangsgr. B. 1.*)

FORMATION OF ANEURISMS.

If the doctrines of Scarpa, published in 1804, had proved correct, the grand distinction of aneurism into *true* and *false* must have been rejected, as erroneous: "for," says he "after a very considerable number of investigations, instituted on the bodies of those who have died of internal, or external aneurisms, I have ascertained, in the most certain and unequivocal manner, that there is only one kind, or form of this disease; viz. that caused by a solution of continuity, or rupture of the proper coats of the artery, with effusion of blood into the surrounding cellular substance: which solution of continuity is occasioned sometimes by a wound, a steatomatous, earthy degeneration, a corroding ulcer, or a rupture of the proper coats of the artery, I mean the internal and muscular, without the concurrence of a preternatural dilatation of these coats being essential to the formation of this disease; and, therefore, that every aneurism, whether it be internal, or external, circumscribed, or diffused, is always formed by effusion." (*Treatise on Aneurism; Transl. by Wishart, Pref.*)

According to Scarpa, it is an error to suppose, that the aneurism at the curvature, or in the trunk of the aorta, produced by a violent and sudden exertion of the whole body, or of the heart in particular, and preceded by a congenital relaxation of a certain portion of this artery, or a morbid weakness of its coats, ought always to be considered, as a tumour formed by the distention, or dilatation of the proper coats of the artery itself, that is, of its internal and fibrous coats. Scarpa considers it quite demonstrable, that such aneurisms are produced by a corrosion and rupture of these tunics, and, consequently, by the effusion of arterial blood under the cellular sheath, or other membrane, covering the vessel. If ever there be a certain degree of preceding dilatation, it is not essential to constitute the disease: for it is not a constant occurrence, most aneurisms are unpreceded by it, and, in those rare cases, in which an aneurism is preceded and accompanied with a certain degree of dilatation of the whole diameter

of the curvature of the aorta, there is an evident difference between an artery simply enlarged in diameter, and the pouch, which forms an aneurismal sac.

Careful dissections, says Scarpa, will prove, that the aorta contributes nothing to the formation of the aneurismal sac, and that this is merely the cellular membrane, which, in the sound state, covered the artery, or that soft cellular sheath, which the artery received in common with the neighbouring parts. This is raised by the blood into the form of a tumour, and is covered, in common with the artery, by a smooth membrane.

This eminent professor does not deny, that, from congenital relaxation, the proper coats of the aorta may occasionally yield and become disposed to rupture; but, he will not admit, that dilatation of this artery precedes and accompanies all its aneurisms, or that its proper coats ever yield so much to distention, as to form the aneurismal sac.

The root of an aneurism of the aorta never includes the whole circumference of the artery; but the aneurismal sac arises from one side in the form of an appendix, or tuberosity. On the contrary, *the dilatation of the artery always extends to its whole circumference*, and, therefore, differs essentially from aneurism. Thus, he urges, that there is a remarkable difference between a dilated and an aneurismatic artery, although *these two affections are sometimes found combined together*, especially at the origin of the aorta. If we also consider that the dilatation of an artery may exist, without any organic affection, the blood being always in the cavity of the vessel: that in an artery so affected, there is never collected any grumous blood, or polypous layers; that the dilatation never forms a tumour of considerable bulk; and, that while the continuity of the proper coats remains uninterrupted, the circulation of the blood is not at all, or not so sensibly changed, we shall be obliged to allow, that aneurism differs essentially from one kind of dilatation of an artery.

Some additional remarks on this topic, more recently published by Scarpa, will be presently considered.

By dissections of arteries, both in the sound and morbid state, Scarpa endeavours to demonstrate what share the proper and constituent coats of the artery have in the formation of the aneurismal sac, and what belongs to the cellular covering, and other adventitious membranes surrounding the artery.

The covering of an artery is merely an adventitious sheath, which the vessel receives in common with the parts in the vicinity of which it runs. On cutting an artery across in its natural situation, the segment of the cut vessel retires and conceals itself in this sheath.

This cellular covering is most evident round the curvature and trunk of the aorta, the carotid, mesenteric, and renal arteries; it is less dense round the trunks of the brachial, femoral, and popliteal arteries. The pleura lies over the cellular sheath of the

arch of the aorta, and over that of the thoracic aorta; while that of the abdominal aorta is covered by the peritoneum. Both these smooth membranes adhere to, and surround, two-thirds of the circumference of the vessel. The great arteries of the extremities are not covered, in addition to the cellular substance, by any smooth membrane of this sort, but by a cellular sheath, which is demonstrably distinct from the adipose membrane, and serves to inclose the vessels, and connect them with the contiguous parts.

When air, or any other fluid, is injected by a small hole made artificially, between the cellular covering, and the subjacent muscular coat of the artery, the injected matter elevates into a tumour the cellular membrane, which closely embraces the artery, without properly destroying its cells, which it distends in a remarkable manner. When melted wax is injected, and pushed with much force, the cellular sheath of the artery is not only raised over the vessel, like a tumour, but, the internal cells of that covering are also lacerated, and, on examining afterwards the capsule of the artificial tumour, it appears as if it were formed of several layers, rough and irregular internally, smooth and polished externally. The same thing happens when any injection is pushed with such force into an artery, as to rupture the internal and muscular coats at some point of their circumference. Nicholls performed this experiment several times before the Royal Society. (*Philos. Trans. an. 1728.*) As soon as the internal coat is ruptured, the muscular one also gives way; but, the external cellular sheath, being of an interlaced texture, and the thin laminae, of which it is composed, being not simply applied to one another, but, reciprocally intermixed, is capable of supporting great distention, by yielding gradually to the impulse of the blood, without being torn, or ruptured.

Scarpa is farther of opinion, that the same phenomena may be observed, when the internal coat of the aorta becomes so diseased, as to be ruptured by the repeated jets of blood from the heart. In this circumstance, the blood, impelled by the heart, begins immediately to ooze through the connexions of the fibres of the muscular coat, and gradually to be effused into the interstices of the cellular covering, forming, for a certain extent, a kind of *ecchymosis*, or *extravasation of blood*, slightly elevated upon the artery. Afterwards, the points of contact, between the edges of the fibres of the muscular coat, being insensibly separated, the arterial blood, penetrating between them, fills and elevates, in a remarkable manner, the cellular covering of the artery, and raises it after the manner of an incipient tumour. Thus, the fibres and layers of the muscular coat being wasted or lacerated, or simply separated from each other, the arterial blood is carried with great force, and in greater quantity than before, into the cellular sheath of the artery,

which it forces more outwards; and, finally, the divisions between the interstices of the cellular coat, being ruptured, it is converted into a sac, which is filled with polypous concretions, and fluid blood, and at last forms, strictly speaking, the aneurismal sac. The internal texture, although apparently composed of membranes placed one over the other, is, in fact, very different from that of the proper coats of the artery, notwithstanding the injured vessel and aneurismal sac are both covered externally, in the thorax and abdomen, with a smooth membrane.

Scarpa has examined a considerable number of aneurisms, of the arch, and of the thoracic, and abdominal trunk, of the aorta, without finding a single one, in which the rupture of the proper coats of the artery was not evident, and in which, consequently, the sac was produced by a substance completely different from the internal and muscular coats.

The aneurismal sac never comprehends the whole circumference of the vessel. At the place where the tumour joins the side of the tube, the aneurismal sac presents a kind of constriction, beyond which it becomes more or less expanded. This would never happen, or rather the contrary circumstance would occur, if the sac were formed by an equable distention of the tube and proper coats of the affected artery. In incipient aneurisms at least, the greatest size of the tumour would then be in the artery itself, or root of the swelling, while its fundus would be the least. But, *whether aneurisms be recent and small, or of long standing and large, the passage from the artery is always narrow, and the fundus of the swelling greater in proportion to its distance from the vessel.* The sac is always covered by the same soft dilatable cellular substance, which united the artery in a sound state to the circumjacent parts. Such cellular substance, in aneurisms of the thoracic aorta, is covered by the pleura, and, in those of the abdominal aorta, by the peritoneum, which membranes include the sac and ruptured artery, presenting outwardly a continued smooth surface, just as if the artery itself were dilated. But, if the aorta be opened lengthwise on the side opposite the constriction, or neck of the tumour, the place of the ulceration, or rupture, of the proper coats of the artery, immediately appears within the vessel on the side opposite to that of the incision. The edge of the fissure, which has taken place, is sometimes fringed, often callous, and hard, and through it it was, that the blood formed itself a passage into the cellular sheath, which is converted into the aneurismal sac. If, as sometimes happens in the arch of the aorta near the heart, the artery, before being ruptured, has been somewhat dilated, it seems, at first, as if there were two aneurisms; but, the constriction, which the sac next to the artery, presents externally, points out exactly the limits, beyond which the internal and muscular coats of the aorta had not been able to resist the distention, and where of course they have been ruptured.

The partition, which may always be seen dividing the tube of the artery from the aneurismal sac, and which is lacerated in its middle, consists of nothing else than the remains of the internal and muscular coats of the ruptured artery.

By carefully dissecting the proper coats of the ruptured aorta in its situation, and comparing them with the cellular substance forming the sac, Scarpa affirms, that the truth of the preceding statement may be indisputably demonstrated.

When an incision is made lengthwise in the side of the vessel opposite the rupture, its proper coats are found either perfectly sound, or a little weakened and studded with earthy points, but still capable of being separated into distinct layers. On the contrary, in the opposite side of the aorta, where the rupture is, the proper coats are unusually thin, and are only separable from each other with difficulty, or even not at all; they are frequently brittle, like an egg-shell, and are disorganized and torn at the place where they form the partition between the ruptured artery and the mouth of the aneurismal sac. Continuing to separate these coats, from within outwards, we arrive at the cellular sheath surrounding the aorta. This sheath being much thickened in large aneurisms, and very adherent to the subjacent muscular coat of the artery at the place of the constriction of the sac, is very apt to be mistaken for a dilated portion of the vessel itself. But, even in such cases, we may at last separate it, without laceration, from the tube of the artery, above and below the injury, and, successively from the muscular coat, as far as the neck of the aneurism. Then it is clear, the muscular coat does not pass beyond the partition, separating the cavity of the artery from that of the aneurismal sac, over which it is not prolonged, but terminates at the edge of the rupture like a fringe, or in obtuse points. Errors are more apt to occur in consequence of the aorta and sac being both covered by the pleura, or peritoneum.

The portion of the aorta, within the pericardium, being only covered by a thin reflected layer of this membrane, such layer may also be lacerated, when the proper coats give way, and blood be effused into the cavity of the pericardium. Examples of this kind are related by Walter, Morgagni, and Scarpa himself. In the latter instance, on making an incision into the concave part of the aorta, opposite the tumour which had formed under the layer of the pericardium, which had also burst by a small aperture, its internal coat, corresponding to the base of the swelling, was quite rough, interspersed with yellow hard spots, and actually ulcerated for the space of an inch in circumference. The preparation is preserved in the museum at Pavia.

But, all other parts of the aorta having, between them and the pleura and peritoneum, a cellular sheath of a stronger and more yielding nature, which allows itself to be distended into a sac, and being strength-

ened internally, by polypous layers, and, externally, by the pleura or peritoneum, oppose for a long while the fatal effusion of blood.

Scarpa believes, that what he calls the slow, morbid, steatomatous, fungous, squamous, degeneration of the internal coat of the artery, is more frequently the cause of its bursting, than violent exertions of the whole body, blows, or an increased impulse of the heart. This kind of diseased change is very common in the curvature, and thoracic and abdominal trunks, of the aorta. In the incipient state of such disease, the internal coat of the artery loses, for a certain space, its beautiful smoothness, and becomes irregular and wrinkled. It afterwards appears interspersed with yellow spots, which are converted into grains, or earthy scales, or into steatomatous, and cheese-like concretions, which render the internal coat of the artery brittle, and so slightly united to the adjoining muscular coat, that, upon being merely scratched with the knife, or point of the nail, pieces are readily detached from it, and, on being cut, it gives a crackling sound, similar to the breaking of an egg-shell. This ossification cannot be said to be proper to old age, since it is sometimes met with in subjects not much advanced in life. The whole of the side of the artery, in that part which is occupied by the morbid affection, is, for the most part, hard and rigid, sometimes soft and fungous, and, in most cases, the canal of the artery is preternaturally constricted. In the highest degree of this morbid disorganization, true ulcerations are found on the inside of the artery, with hard and fringed edges, fissures, and lacerations of the internal and fibrous coats of the artery.

Having presented the reader with an abridged account of the most important remarks made by Scarpa, in support of the doctrine he defends, I now annex his conclusions. 1. That this disease is invariably formed by the rupture of the proper coats of the artery. 2. That the aneurismal sac is never formed by a dilatation of the proper coats of the artery, but, undoubtedly, by the cellular sheath, which the artery receives in common with the parts contiguous to it; over which cellular sheath the pleura is placed in the thorax, and the peritoneum in the abdomen. 3. That if the aorta, immediately above the heart, appears sometimes increased beyond its natural diameter, this is not common to all the rest of the artery, and when the aorta, in the vicinity of the heart, yields to a dilatation greater than natural, this dilatation does not constitute, properly speaking, the essence of the aneurism. 4. That there are none of those marks regarded by medical men as characteristic of aneurism from dilatation, which may not be met with in aneurism from rupture, including even the circumscribed figure of the tumour. 5. That the distinction of aneurism into *true* and *spurious*, adopted in the schools, is only the production of a false theory; since observation shows, that there is only one form of

the disease, or that caused by a rupture of the proper coats of the artery, and an effusion of arterial blood into the cellular sheath, which surrounds the ruptured artery. (See *Treatise on Aneurism, by A. Scarpa, trans. by J. H. Wishart, Edin. 1808.*)

Such were the inferences made by Scarpa, in 1804, one of the most distinguished anatomists and surgeons of the present day upon the continent. It has been already stated, that great as this authority is, several eminent modern surgeons, as Richerand, Boyer, Dubois, Dupuytren, Sabatier, Breschet, &c. did not yield to it, but still contended that in some aneurisms, the coats of the artery were dilated. These professors in France coincided with what has been usually taught upon this subject in the surgical schools of Great Britain. Every lecturer here has been accustomed to describe the distinctions of aneurisms into true and false, or into some cases which are accompanied with dilatation, and into others, which are attended with rupture of the arterial coats. A few years ago, Mr. Hodgson, of Birmingham, published a valuable treatise on aneurism, in which work he differs from Scarpa, and joins those surgical writers who believe in the occasional dilatation of the coats of the arteries in this disease. He inquires: "Is every aneurism produced by a destruction of the internal and middle coats of the vessel, and does not a partial dilatation of these coats occasionally precede, and give rise to their destruction; I believe that this is frequently the case. We have seen that the disorganization of the coats of an artery, by destroying their natural elasticity, will give rise to permanent dilatation of the whole circumference of the vessel; and there is every reason to expect, that a loss of its elasticity in a portion only of the diameter of the vessel will give rise to a partial dilatation of its coats. Indeed, the proofs of a partial dilatation of the coats of an artery, particularly of the aorta, are incontestably established by the possibility of tracing the coats of the vessel throughout the whole extent of the expansion, and by the existence of those morbid appearances in the sac, which are peculiar to the coats of the arteries.

"In the year 1811, (says Mr. Hodgson,) I dissected an aneurism of the aorta, which was removed from the body of a young woman by my friend Dr. Farre. The sac was as large as a small melon, and had proved fatal by bursting into the posterior mediastinum, and subsequently into the cavity of the thorax. This aorta exhibited the formation of aneurism by partial dilatation in three distinct stages. The internal coat was throughout inflamed, and presented a fleshy and irregular appearance. At the arch of the aorta, there was a dilatation not larger than the half of a small pea. About two inches lower in the same vessel, was a second dilatation, which would have contained a hazel nut, and immediately above the diaphragm was the large aneurism, which had proved fatal. I removed that

portion of the vessel, which contained the smallest dilatation, and macerated it until its coats could be separated without violence. I found that the dilatation existed equally in the three coats of the vessel, and, when separated, each presented the appearance of a minute aneurism. The second dilatation exhibited the same circumstances in a more advanced stage. The coats of the vessels were more intimately adherent to each other, than in a natural state, but, it was evident, that the dilatation consisted in a dilatation of the internal, the middle, and the external coats of the aorta. In the large aneurism, the disorganized internal and middle coats could be traced for some distance into the sac, when the parts contained in the posterior mediastinum, and the vertebræ, formed the remainder of the cyst. There can be little doubt, that this sac commenced in a dilatation of the coats of the vessel, similar to those appearances which existed in the superior portion of the artery, and the dissection appeared to illustrate the formation of aneurism by partial dilatation in three distinct stages." (*Hodgson on the Diseases of Arteries and Veins*, p. 66, 68.) As far as Kreysig's information extends, nobody before Mr. Hodgson, had examined the structure of an aneurismal sac in this accurate manner, viz. by maceration, and the results, he thinks, are not liable to the slightest objections. (See the *German Transl. of Mr. Hodgson's work, with notes by Kreysig and Koberwein*, p. 109, Hanover, 1817.)

Mr. Hodgson has seen this partial dilatation in almost all the arteries, which are subject to aneurism: at the division of the carotids, and iliacs; in the arteries of the brain, &c.; and he agrees with Dr. Baillie, (*Morbid Anatomy, &c.*) Laennec, *Cerutius Beschreib. d. Krankh. Préparate d. Anat. Theatres zu Leipzig*, p. 408, 8vo. 1819,) and others, that aneurisms at the origin of the aorta are generally formed by dilatation of the coats of the vessel.

"Partial as well as general dilatation (says Mr. Hodgson,) frequently precedes the formation of aneurism in the arteries of the extremities. A gentleman had a large aneurism in the thigh, which had undergone a spontaneous cure. Upon examining the limb after death, the popliteal artery was found to be thickened and covered with calcareous matter. A small pouch, which would have contained the seed of an orange, originated from the side of this artery. This little sac was evidently formed by a dilatation of the coats of the vessel; for, the internal and middle coats could be traced in its circumference, and the former in that situation exhibited the same morbid appearances, which it possessed in other parts of the vessel. A man died from the sloughing of an aneurism in the ham: in the femoral artery there was a small aneurism, about as large as a walnut. The external coat was dissected from the surface of the tumour to a considerable extent. The internal and middle coats were

evidently dilated, and contributed to the formation of the sac. The dilatation of these coats was gradual, and they continued for a considerable distance to form the sac, when they were inseparably blended with the surrounding parts." (*Op. cit.* p. 70.)

When Mr. A. Burns bears testimony to the fidelity and accuracy of Scarpa's general detail, he adds, that perhaps it may not be uniformly found, that "the root of an aneurism never includes the whole circumference of the tube of an artery." We have, says he, a preparation, in which the reverse has taken place. In this case, the whole cylinder of the vessel, from the heart to beyond the curvature, is equally dilated; and dilated to such an extent, that the tumour measures no less than ten inches in circumference. Scarpa limits dilatation, says Mr. Burns, to that state of an artery, in which the coats remain in their natural relation to each other, and in which they are not altered in their texture, nor lined on their inner surface with "polypous layers." "This, however, was not the case in the instance which I have brought forward. In it you have seen that the coats were much dilated, and also very much altered in their structure. Externally and internally, they had assumed the look of the membranes of the fœtus, only they were thicker and denser, but they were equally gelatinous and nearly as transparent; and, on their inner surface, they were crusted over with laminae of coagulating lymph. By peeling off this incrustation after the sac had been inverted, we saw plainly, that although the internal coats were round the complete cylinder of the vessel much diseased, and considerably dilated, yet they were not dilated in the same degree as the external coverings of the artery. At irregular distances, longitudinal rents were formed in the fibrous coats, and these chasms were filled with coagulating lymph. The internal coats, over the whole circumference of the vessel, had assumed the diseased condition, which in aneurism is generally confined to a part of the cylinder. In this tumour, all the coats continued for a time to dilate equally, but at length the internal gave way, forming longitudinal rents, through which the external coats could be seen, after the lymphatic coating had been scraped off. In this instance, had the sac been dissected in the early stage, it would have presented precisely the same appearances as those described by Dr. Monro, and the one (the aneurism) lately examined by the surgical editor of the *London Med. Review*." Mr. Burns afterwards expresses doubts, whether the sac can ever acquire a large size without dilatation. The case, reported in the latter periodical work, was the largest, that he knew of, in which all the coats were found uniformly dilated. The sac, which was as large as the fist, was lined throughout with flakes of bone, and though the internal coat of the vessel was thus patched, and extremely thin and brittle, it did not, on minute inspection, any where exhibit a solution

of continuity. Mr. A. Burns further states, that the above case reported by himself, was the only one out of fourteen, which did not corroborate Scarpa's description. (*On Diseases of the Heart, &c.* p. 204.) Mr. Wilson, after mentioning the frequency of aneurism in the aorta, carotid, subclavian, and axillary arteries, and its rarity in the brachial, tells us, that he knows of no example of aneurism below the elbow, where the swelling could not be traced to a wound of the coats of the artery. He adds, that true aneurism has not unfrequently occurred in the internal and external iliac arteries, in the inguinal, femoral, and very frequently in the popliteal. It has taken place in the posterior tibial artery, but he knows of no instance of it in the anterior tibial, or peroneal arteries. "I have (says he) met with only one instance of true aneurism affecting any of the branches of the aorta, which are distributed to the abdominal viscera. In the year 1809, on inspecting the body of a clergyman, in the presence of the late Sir W. Farquhar, a tumour, very much resembling the heart in colour, shape, and size, appeared to hang down from the under surface of the left lobe of the liver. When this tumour was opened, and carefully inspected, it appeared to have been formed by the left branch of the hepatic artery having become very much enlarged and aneurismal. It had burst, and the blood, which had escaped, was found in an imperfect cyst, partly in a fluid, and partly in a coagulated state, forming a large proportion of the tumour." This preparation is in Windmill Street. (See *Lectures on the Blood, and on the Anatomy, Physiology, and Surgical Pathology of the Vascular System*, p. 379, 380, *Svo. Lond.* 1819.)

The facts adduced by Mr. Hodgson appear sufficiently conclusive, and from them the following doctrine is clearly deducible.

First, That numerous aneurisms are formed by destruction of the internal and middle coats of an artery, and the expansion of the external coat into a small cyst, which giving way from distention, the surrounding parts, whatever may be their structure, form the remainder of the sac.

Secondly, That sometimes the disease commences in the dilatation of a portion of the circumference of an artery. This dilatation increases until the coats of the vessel give way, when the surrounding parts form the sac, in the same manner as when the disease is in the first instance produced by destruction of the coats of an artery. (*P. 74.*)

The conclusions of Mr. Hodgson, as he himself explains, are supported by the observations of numerous writers.

The learned Sabatier says, there can be no doubt, that many aneurisms depend upon the dilatation of the arterial coats; but, continues he, when this happens, the cases present remarkable differences. Sometimes the three arterial tunics are dilated altogether. In other instances, only the two internal coats are affected with dilatation. *While, in far more numerous examples, the internal tunics are ruptured, and it is the cel-*

lular coat alone, which separates from them, and enlarges, so as to form the aneurismal sac; "de sorte que les artères, qui sont dans ce cas, sont diloriquées, suivant l'expression d' Lancisi."

It is difficult to conceive, observes Sabatier, how all the coats of an artery can dilate and yield sufficiently to form the investment of such immense tumours as some aneurisms are. Indeed, that very tunic, which composes the greater part of the thickness of the vessel, and which is termed the *muscular coat*, is known to consist of fibres whose texture is firm, and little capable of bearing extension. However, Sabatier states, that there are some observations, which prove, that the muscular tunic may become dilated as well as the others. Haller, in describing a very large aneurism, situated in the aorta near the heart, relates, that the innermost coat of this vessel was ruptured and torn, the loose jagged edges of the laceration being visible in the aneurismal sac. These were squamous, bony, and of little thickness; while the muscular and cellular coats were quite sound. Donald Monro noticed the same thing in five different aneurisms, which occurred in the course of the femoral and popliteal arteries of a man, who had been confined a long while to his bed, after submitting to the operation for bubonocoele. Monro succeeded in tracing the fibres of the muscular coat over the swellings, so that he had no doubt of this tunic being dilated. Sabatier thinks, that it is not to be inferred, that all such writers, as have related the histories of true aneurisms, proceeding from a dilatation of all the arterial coats, can have been mistaken, although they may not have minutely described the texture of the sac, in which the blood was contained. He inclines to the opinion, however, that most of these aneurisms were similar to those, which result from the rupture of the internal tunics of the arteries, and the dilatation of the cellular coat; for the fragments of the lacerated coats are often blended with osseous, steatomatous, or purulent matter, and confounded with the cellular coat that forms the exterior investment. (See *Médecine Opératoire*, T. 3. p. 160—162.)

According to Richerand, when an aneurism is recent and of small size, the dissection of the tumour exhibits a simple dilatation of the arterial coats; while, in other cases, where the aneurism is large, and has existed a considerable time, the internal and middle coats of the vessel are invariably lacerated. In the early stage of the disease, the blood, which fills the aneurismal sac, is fluid, and on the contrary, in cases, where the internal tunics of the artery are ruptured, the sac contains more or less coagulated lymph. The external, or cellular coat, composes the greater part of the cyst; and the coagulated lymph, with which it is filled, is arranged in layers, the density of which is described as being greater in proportion to the length of time, which they have been deposited. Such as are nearest the sac are, therefore, represented as being most

compact, and containing the smallest quantity of the colouring matter of the blood; more deeply, the concretions of lymph resemble simple coagula; and lastly, the blood which is still nearer the arterial tube, retains its fluidity.

After the aneurismal sac has been cleansed from the lymph and coagulated blood, which it contains, its parietes will appear to be almost entirely formed of the cellular coat of the artery. Towards the bottom may be observed the aperture, arising from the laceration of the internal and middle coats, which, being much less elastic than the external, are ruptured in an early stage of the disease. It is when these two tunics give way, that the aneurismal tumour undergoes a sudden and considerable increase in its size; for, then, the cellular coat alone has to sustain all the pressure of the blood, which, now becoming effused into a more ample cyst, loses a great deal of its impetus, coagulates, and forms fibrous masses; circumstances to which may be ascribed the hardness of the swelling, the weakness of its pulsation, &c." (*Nos. Chir. T. 4. p. 82. Ed. 2.*)

But, this author seems to venture far beyond the bounds of accuracy, when he represents every small aneurism, as exhibiting a dilatation of the arterial coats, unless his meaning refer more particularly to the outer coat alone.

The reality of what are called true internal aneurisms was ably urged by C. F. Ludwig, in a programma written expressly on that subject. (*Diagnostices Chir. Fragm. de Aneurymate Interno; Lips. 1805.*) But an interesting case, exemplifying an aneurismal dilatation of all the coats of the abdominal aorta, has been recently published by Professor Nægele, of Heidelberg. The swelling was as large as a man's head, and weighed about five pounds. The aorta began to be dilated at the point, where it passes into the cavity of the abdomen between the crura of the diaphragm. This dilatation extended gradually down to a point, about four finger-breadths from the bifurcation of the aorta into the iliac arteries, at which point, strictly speaking, the large aneurismal sac commenced. The length of the whole dilated part of the vessel was eleven inches, that of the sac, six, and its diameter five inches. The artery was not equally dilated in every direction, the expansion being most considerable laterally, and forwards. Professor Nægele and Ackermann found, that the three coats of the aorta, the internal, muscular, and cellular, were all equally dilated. These gentlemen traced the muscular coat with a scalpel from the top to the bottom of the tumour, and not the slightest doubt could be entertained, that the case was a true aneurism. (*F. C. Nægele. Epistola ad T. F. Balts, quâ Historia et Descriptio Aneurysmatis, quod in aorta abdominali observavit, continetur, Heidelberg. 1816.*)

After the clear demonstration of an aneurismal sac being occasionally composed of all the coats of an artery, as afforded in the dissections and pathological preparations, to which a reference has been made, the reader

will be better prepared to judge of the difference existing upon this subject between Scarpa and other modern writers, and as far as I can judge, the question is now reduced to one, whether any of the dilatations on record, said to comprise all the arterial coats, merit the name of aneurism. We have seen, that he has always unequivocally admitted that the arteries may be dilated, though the kind of dilatation, to which he alludes, is thought by him, as well as by A. Burns, and my friend Mr. Hodgson, (*On Diseases of Arteries, &c. p. 58.*) to require discrimination in a pathological point of view. "It is proved (says Scarpa) by dissection, that the morbid dilatation is circumscribed by the proper coats of the diseased artery; and that the inner surface of the sac, formed by the *partial*, or total protrusion of the arterial tube, is never filled with polypous laminæ, or layers of fibrine disposed over each other; (a fact particularly dwelt upon by Mr. Hodgson, p. 82.) which layers never fail to be formed in greater or smaller quantity in the cavity of an aneurism. "The opinion, that these layers of coagula are not met with in small dilatations of arteries, but are found in large expansions of them, he says, is contradicted by numerous careful observations, and especially by a specimen, actually before him when he was writing, where a morbid dilatation of the arch of the aorta, in the vicinity of its origin from the heart, six inches in length, and five in breadth, was entirely free from any of the lamellated coagula, always found in aneurisms. On the contrary, the sac of the aneurism is formed from the parts surrounding the wounded, or ruptured artery, into which pouch, the blood, entering as into a natural receiver, and quite out of the current of the circulation, moves only slowly, and constantly deposits these layers of fibrine, and this sometimes in such quantity as to fill the whole cyst. Scarpa, at the same time, particularly explains, that, if accidentally furrows, or fissures exist on the inside of the morbid dilatation, the fibrine may be deposited in these rough places, but only in them. These fissures and inequalities of the internal surface of the morbidly dilated artery, he regards strictly as so many beginnings of another disease of the vessel, quite different from dilatation, that is, of aneurism subsequent to dilatation. See *Memoria sulla Legatura delle principali Arterie degli Arti con una Appendice all' Opera sull' Aneurisma* fol. Pavia, 1817. or the *Treatise on Aneurism*, transl. by Wishart, Ed. 2, p. 119, Edinb. 1819.

In this manner, no doubt, Scarpa would account for the presence of lamellated coagula in the case reported by Mr. A. Burns, (*On Diseases of the Heart. p. 306.*) though the latter gentleman himself, for reasons already detailed in the foregoing pages, did not regard the expansion of all the coats of the artery, as corresponding to the morbid dilatation implied by Scarpa. Thus Scarpa further agrees with other modern writers, in admitting the possibility of aneurism becoming ingrafted, as it were, in one of these

unnatural dilatations, more than one example of which combination were indeed recited in his first work. In that treatise, he has asserted, that what he calls morbid dilatation, always extends to the whole circumference of the vessel. But, this point seems from the appendix to be renounced, as he now observes, "Where the morbid dilatation is partial, or on one side of the artery, like a thimble, (for, very frequently, even in the arch of the aorta, this partial dilatation does not exceed the size of half a bean,) the entrance for the blood into this capsule is as large as the bottom of the sac." (*Transl. by Wishart, p. 120, Ed. 2.*) According to Scarpa, where the morbid dilatation occupies the whole circumference of the arterial tube, the tumour always retains a cylindrical or oval form; and, if situated in such manner, that it can be compressed, it yields very readily to pressure, and almost disappears; and, after death, is found much smaller, than during life. On the contrary, *aneurism*, whether preceded by dilatation, or not, constantly originates from one side of the ruptured artery. The entrance for the blood is small, compared with the size of the fundus of the sac; the tumour assumes an irregular shape; yields with difficulty to pressure; retains nearly the same size in the dead, that it had in the living body; and, its sac, instead of becoming thinner as the swelling enlarges, like the coats of an artery do, when they are simply affected with dilatation, attains greater thickness, the larger the aneurism grows. These essential differences, between the two diseases, are illustrated by an interesting case, met with by Professor Vacca, where a patient died with an aneurism of one subclavian artery, and a simple morbid dilatation of the whole circumference of the other. (See *Sprengel, Storia delle Operaz. di Chir. Trad. Ital. Parte 2, p. 294.*)

When these two different affections are situated in the thorax, or abdomen, it is impossible to discriminate them from each other before death. The symptoms, occasioned by the pressure of the tumour on the viscera, must be nearly the same, whether caused by a morbid dilatation, or an aneurism. The means for retarding their fatal termination is also the same in both forms of the disease. With regard to the possibility of cure, however, Scarpa says, that there is great difference; for, when the case is an internal aneurism, there may be some slight hope of a radical cure by the efforts of nature and art, which hope can never be entertained in a case of morbid dilatation; a fact, which is accounted for by no laminated coagula being deposited in the latter disease. (*On Aneurism, transl. by Wishart, p. 124, Ed. 2.*) A great deal of the latter statement coincides with the observations of Mr. Hodgson, who particularly notices, that he has never met with lamellated coagula in such sacs, as consist either in a general, or partial dilatation of the coats of the vessel. (*On diseases of Arteries, &c. p. 82.*) Whether this ever takes place in such cases may still

be a question, because if Professor Nægele has given a correct description of the aneurism of the abdominal aorta, already mentioned, which aneurism was of large size, and consisted of a dilatation of all the coats of the vessel, there was in this rare example a large quantity of these layers of coagulated blood. Yet, whether the professor actually means the fibrine, arranged in laminae, or only common coagulated blood, which, as every one knows, may be found either in the cysts of dilated, or of ruptured arteries, may admit of doubt. The statement, therefore, made by Hodgson and Scarpa, may not be contrary to what was really seen by Nægele and Ackermann. The following case, however, observed by Laennec, and quoted by a modern writer, must (if correctly reported,) afford not only an unequivocal specimen of aneurism by dilatation of all the coats of the aorta, but, of laminated coagula within its cavity. "In homine enim, qui repente sub atrocissimis pectoris doloribus corruit, præter aortam ascendentem in aneurysma ita expansam, ut neonati infantis caput æquaret, cystidem aneurismaticam immediate supra arteriæ celiacæ ortam magnitudine nucis juglandis invenit, quæ luculenter ostendit sinum communicantem cum arteriæ cylindro per foramen magnitudine amygdalæ, diametro totius arteriæ illo loco non mutato. Saccus hic cultro anatomico accurate ac subtiliter subjectus, eamdem structuram, eandem ostendit membranas, quibus gaudebat arteria, e cujus latere excreverat; cæterum massis grumosis, sive fibrosis erat impletus. Inde igitur patet, hoc aneurysma sacciforme et laterali et partiali quidem tunicarum aortæ dilatatione ortum esse." (*J. H. G. Ehrhardt, De Aneurysmate, Aortæ, p. 13, 4to. Lips. 1820.*)

From what has been stated, it appears then, that there is only one principal point of difference between Scarpa and other writers; and this resolves itself into the question, whether a dilatation of an artery, arising at one particular side of the vessel, and lined by its internal coat, ought not to be regarded as an aneurism, because its communication with the tube of the artery is more capacious, than what exists in other aneurisms, where the inner coat has given way, and because it rarely (perhaps never) contains laminated coagula, unless fissures should happen to exist at some points of the inner arterial tunic thus expanded.

The greater number of aneurisms increase gradually, and sooner or later incline to the side, on which the least resistance is experienced. De Haen mentions an aneurism of the aorta, which first made its appearance between the second and third ribs of the left side, and, which instead of growing larger, as is usual, subsided, and could neither be seen, nor felt, for more than a month before the patient's decease, although, on opening the body, a tumour of the arch of the aorta was found, three times as large as the first. De Haen imputes the sudden disappearance of the swelling to its weight, the yielding of the parts with which it was connected, and to

its gravitating into the chest, when the patient lay on his right side; for, the difficulty of breathing, and other complaints, produced by the pressure on the lungs, underwent a material increase, as soon as the tumour ceased to protrude.

The pulsations which accompany true aneurisms, continue to be strong, until the inner coats of the vessel give way, or the layers of coagulated blood, lodged in the sac, are numerous. Hence, when soft swellings, situated near any large arteries, lose their pulsatory motion, their course, precise situation, and other circumstances, ought to be most carefully investigated, before any decision is made about the mode of treatment.

In St. Bartholomew's hospital, I saw a man, about three years ago, who had a large swelling of great solidity, occupying the ham, and apparently extending a good way forwards round the condyles of the femur. Its hardness, shape, large size, and entire freedom from pulsation, not only then, but at an earlier period, as far as could be collected from the patient's own account, led to the belief, that the case was probably a tumour complicated with exostosis of the femur, and as this opinion seemed to be confirmed by no fluid escaping from a puncture made with a lancet, amputation was performed. To our surprise, however, dissection proved, that the disease was a large diffused popliteal aneurism, in which the spontaneous cure by an obliteration of the sac with coagula was taking place. (See *Med. Chir. Trans. Vol. 8, p. 497.*)

In many instances, the most fatal accidents have happened, in consequence of incisions having been made in aneurisms, which were mistaken for abscesses, because there was no pulsation. Vesalius was consulted about a tumour of the back, which he pronounced to be an aneurism. Soon afterwards, an imprudent practitioner made an opening in the swelling, and the patient bled to death in a very short time. Ruysch relates, that a friend of his, having opened a tumour near the heel, which was not supposed to be an aneurism, the greatest difficulty was experienced in suppressing the hemorrhage. De Haen speaks of a patient, who died in consequence of an opening, which was made in a similar swelling at the knee, although Boerhaave had given his advice against the performance of such an operation. Palfin, Schlitting, Warner, and others, have recorded mistakes of the same kind. (*Sabatier, Tom. 3. p. 167.*) Riche-rand informs us, that Ferrand, head surgeon of the Hôtel-Dieu, mistook an axillary aneurism for an abscess, plunged his bistoury into the swelling, and killed the patient. "*J'ai été témoin d'erreurs semblables, commises par les praticiens non moins fameux; et si des anéurismes externes on passe à ceux des artères placées à l'intérieur, les erreurs ne sont ni moins ordinaires ni de moindre conséquence.*" (*Nosogr. Chir. T. 4, p. 75, Ed. 2.*)

Notwithstanding a pulsation is one of the most prominent symptoms of an aneurism, it is not to be inferred, that every swelling

which pulsates is unquestionably of this description; for, as Mr. Warner has explained, it does happen, that mere imposthurations, or collections of matter, arising from external as well as internal causes, are sometimes so immediately situated upon the heart itself, and, at other times, upon some of its principal arteries, as to partake, in the most regular manner, of their contraction and dilatation.

"A few years ago," says he, "I saw an instance of a boy, about thirteen years of age, who had his breast-bone much fractured by a fall; on this account, he was admitted into Guy's Hospital; but, not till a fortnight after the accident had happened.

"Upon examination, there was an evident separation of the broken parts of the bone, which were removed some distance from each other. The intermediate space was occupied by a tumour of a considerable size; the integuments were of their natural complexion. The swelling had as regular a contraction and dilatation as the heart itself, or the aorta could be supposed to have. Upon pressure, the tumour receded; upon a removal of the pressure, the tumour immediately resumed its former size; all these are allowed to be distinguishing signs of a recent true aneurism. The situation and symptoms of this swelling were judged sufficient reasons for considering the nature of the disease as uncertain; on which account it was left to take its own course.

"The event was, the tumour burst in about three weeks after his admission; discharged a considerable quantity of matter; and the patient did well by very superficial applications." (*Cases in Surgery, Edit. 4. p. 155.*)

An extraordinary form of disease, having very much the appearance of an aneurism, sometimes presents itself. A swelling, attended with considerable pain, and a strong pulsation, is gradually produced high up the arm; and at length attains a very large size. The strength of the throbbings at first leads to the suspicion, that the case must be an aneurism; but, on careful examination, the humerus is found to have given way at a point involved in the disease, and here to be as flexible, as if there were a fracture. This circumstance, and the extension of the swelling too far away from the track of the artery, in time raise doubts about the case being an aneurism. The patient ultimately falls a victim to the effects of the disease on the constitution, and, when the arm is dissected after death, the tumour is found to consist of a sarcomatous, or medullary mass, occupying the central portion of the limb, and accompanied with a solution of continuity extending completely through the whole thickness of the bone. Two cases of this description have been admitted into St. Bartholomew's hospital in the course of the present year (1820.) One of these patients, a woman, I had an opportunity of seeing; and, since her death, the real nature of the disease has been proved by dissection. My friend Mr. Vincent has seen a

similar disease in the leg, resembling aneurism in the circumstance of pulsation, but attended with destruction of a part of the tibia, and a moveableness of the separated ends of the bone.

A few years ago, I saw a large abscess in the situation of the quadratus lumborum muscle, which pulsated so strongly, that the case was supposed by several experienced men to be an aneurism of the abdominal aorta. The patient was a boy, belonging to Christ's Hospital, and under the care of the late Mr. Ramsden, surgeon to that establishment, by whose discernment the real nature of the case was detected. It is curious, that, in this instance, the pulsations of the swelling suddenly ceased, after having continued in a very strong and manifest way, and without interruption, for several weeks, during which it was under the observation of the above eminent practitioner.

As Mr. Wilson has observed, any encysted or even solid tumour, situated in the neighbourhood of, or upon a large artery, may have a considerable degree of motion communicated to it from the pulsation of the artery. The thyroid gland, when a bronchocele is formed, occasionally receives a pulsatory motion from the carotid arteries. This may be mistaken for an aneurism, from which disease, however, it can be discriminated by placing our fingers behind the tumour, and drawing it forwards when the pulsation ceases. But, there are other criteria for distinguishing a swelling on or near an artery, from an aneurism. In such a case, the whole tumour moves at once, without any alteration of size. In an aneurism, the swelling does not simply move, it expands. A tumour of the thyroid gland, having apparently a pulsatory motion, may be known not to be an aneurism of the carotid, by observing, that, from its connexion with the larynx, it follows the movements of the latter in deglutition. Aneurisms, which are not of very long standing, and do not contain a large mass of laminated coagula, may also be diminished or rendered more or less flaccid, by pressing the artery leading to the disease. (See *Wilson's Lectures on the Blood, Anatomy, Pathology, &c. of the Vascular System*, p. 386, and *Burns on the Heart*, p. 257.)

The following case recorded by Pelletan, shows, that an artery running more superficially, than natural, may, under particular circumstances, give rise to the suspicion of an aneurism. A strong robust man, about forty years of age, was in the habit of going on foot to dine, three leagues from Paris, every day, on the completion of his business. One day, having been this distance, and returned, he felt an acute pain along the leg, and in the right ankle. The pain did not subside, and a tumour appeared at the lower third of the leg, opposite the space between the two bones. The skin was of a yellowish colour from effused blood, and a pulsation existed, by which the hand of an examiner was lifted up. There seemed

every reason for concluding, that the case was an aneurismal swelling. In comparing the affected limb with the sound one, however, Pelletan perceived in the latter a similar kind of throbbing. In short, in both legs, the pulsation of an arterial tube could be felt for three inches, and, Pelletan distinctly ascertained, that in the diseased member, the throbbing did not extend to the whole of the tumour, but only lengthwise. By a particular disposition in this individual, the anterior tibial artery, which usually runs along the interosseous ligament, covered by the tibialis anticus, and extensor communis digitorum pedis, came out from between these muscles, at the middle of the leg, and lay immediately under the skin and the fascia. The patient, curious about the circumstance, which had been mentioned to him, examined the legs of the whole of his family; and it appeared, that his daughter was the only one, in whom the anterior tibial artery ran directly under the skin, in the same way, as it did in himself.

By confining the patient to his bed, says Pelletan, we were soon convinced, that the disease was not an aneurism; for the swelling and ecchymosis were gradually dispersed, and, it is more than probable, that the symptoms originated from the rupture of some muscular fibres, in the exertion of walking so great a distance. (See *Pelletan's Clinique Chirurgicale*, T. 1. p. 101, 102.)

Whenever an aneurismal sac of an immoderate size beats violently, and, for a long while against a bone, as the sternum, ribs, clavicle, and vertebrae, the bones are in the end invariably destroyed, so that the aneurismal sac elevates the integuments of the thorax, or back, and pulsates immediately under the skin. Scarpa, with the best modern writers, attributes the effect to absorption, in consequence of the pressure.

J. L. Petit saw the condyles of the femur, and the upper head of the tibia, almost destroyed by an aneurism of the popliteal artery; and another case, in which the caries and absorption of bone were very extensive, is reported by Rosenmüller. (*Anhang zu Scarpa ab. d. Pulsadergeschwulste*, p. 364.) According to Mr. Hodgson, the carious and corroded state of the bones in aneurism is never attended with the formation of pus; "at least, the discovery of pus in its vicinity has not been remarked by those, who have examined such cases. In this respect, therefore, it differs essentially from common caries, or ulceration of bones. Exfoliation also is very rarely attendant upon it; from which circumstance, one important practical observation is deducible, namely, that if the aneurism be cured, the bones will recover their healthy state, without undergoing those processes, which take place in the cure of caries or necrosis." (*On the Diseases of Arteries and Veins*, p. 80.)

The same author confirms the remark made by Dr. W. Hunter, (*Med. Obs. and Inquiries*, p. 348;) Scarpa, (*On Aneurism*, p.

100, *Ed. 2.*) and others, that cartilage is less rapidly destroyed by the pressure of an aneurism than bone. This fact is strikingly illustrated in a case of aneurism of the thoracic aorta, recorded in another modern publication: the bodies of the vertebræ from the fourth down to the ninth were carious; the four lowermost particularly so; yet, the intervertebral cartilages were not materially affected, (*F. L. Kreysig, Die Krankheiten des Herzens, B. 3, p. 176, 8vo. Berlin. 1817.*)

A case is related by Pelletan, which is highly interesting, not only as exemplifying the degree, in which internal aneurisms may injure the vertebræ; but also as showing the occasional possibility of such diseases being mistaken for rheumatism, or a lumbar abscess, with or without caries of the spine.

After various complaints, like those of rheumatism, an oval tumour, imperfectly circumscribed, presented itself in the right iliac region, in the track of the psoas muscle. It was attended with a distinct fluctuation, and might easily have been mistaken for a collection of matter. But, on attentive examination, pulsations were felt, which, as they increased from day to day, left no further doubt concerning the nature of the swelling.

On opening the body after death, an aneurismal tumour of prodigious size was discovered. It filled the cavity of the abdomen, from the lumbar and iliac regions of the right side, to the lumbar region of the left side, and it extended from the trunk of the celiac artery down to the bifurcation of the aorta. The trunk of the aorta divided the tumour into two pouches, of which the right was far the largest, occupying the iliac and lumbar regions. The swelling enveloped the right kidney, and was externally covered by the peritoneum, which membrane was pushed to some distance from the bowels. The quantity of blood, which the aneurism contained, was about five pints; three of which were in its right cavity, and two in its left. This fluid was nearly all in a coagulated state, the coagula being arranged in concentric layers, as is usual in such cases. The centre of the disease presented an oval opening, about three inches long, and one broad, formed in the posterior part of the aorta, between the celiac and superior mesenteric arteries. Opposite to this aperture, the bodies of the two last dorsal, and of the two first lumbar vertebræ, were destroyed; an ordinary effect of aneurism on such bones as happen to be near them, but which effect Pelletan had never previously seen take place in so considerable a degree. In fact, in this case, while the patient was alive, the lowermost dorsal vertebræ had actually caused a deformed appearance externally, from the effect of the pressure of the tumour on that part of the spine. This was the largest aneurism Pelletan ever saw; and he ascribes the man's death to nearly the whole mass of the blood being in the aneurismal sac, as most of the vessels, and the heart itself,

were quite empty. (*Clinique Chir. T. 1, p. 97, 100.*)

CAUSES OF ANEURISM.

Aneurisms often seem to originate spontaneously, it being in many instances exceedingly difficult to assign any cause for the commencement of the disease. Among the circumstances, which predispose to aneurisms, however, the large size of the vessels may undoubtedly be reckoned. Those trunks, which are near the heart, are said to have much thinner parietes, in relation to the magnitude of the column of blood, with which they are filled, than the arteries of smaller diameter; and since the lateral pressure of this fluid against the sides of the arteries is in a ratio to the magnitude of these vessels, it follows, that aneurisms must be much more frequent in the trunks near the heart, than in such as are remote from the source of the circulation. (*Richerand, Nosogr. Chir. T. 4, p. 72. Edit. 2.*) The whole arterial system is liable to aneurisms; but, says Pelletan, experience proves that the internal arteries are much more frequently affected, than those which are external. (*Clinique Chirurgicale, Tom. 1, p. 54.*)

The curvatures of the arteries are another predisposing cause of the disease, and, according to Richerand, such cause has manifest effect in determining the formation of the great sinus of the aorta, the dilatation, which exists between the cross and the origin of this large artery, and is the more considerable, the older the person is: Monro even thought, that one half of old persons have an aneurism at the beginning of the aorta. And with respect to aneurisms in general, which are preceded by calcareous depositions, thickening, and disease of the coats of the vessel, they are most frequently met with in persons of advanced age. Aneurisms from wounds are of course often seen in individuals of every age. In old people, the coats of the arteries are subject to a disease, which renders them incapable of making due resistance to the lateral impulse of the blood. The disease, here alluded to, is what is described in a foregoing part of this article, one common effect of which is the deposition of calcareous matter between the inner and muscular coats of the arteries. "People in the early part of life, says Mr. Wilson, are not very subject to these calcareous depositions; but, I have occasionally met with them in the arteries of very young people. I have seen a well-marked deposition of the phosphate of lime in the arteries of a child under three years of age." He adds, that few persons, above the age of sixty, are free from these ossifications. (See *Lectures on the Blood, and on the Anatomy, Pathology, &c. of the Vascular System, p. 375, Lond. 1819.*)

Though spontaneous aneurisms are most common in old persons, the disease is not absolutely confined to them; for I assisted Mr. Docker at Canterbury in an operation

for the cure of a popliteal aneurism in a position, whose age must have been under thirty; and Mr. Wilson says, that he has met with several instances of the disease in the aorta and other vessels, where the patients were not more than forty years of age. (*Op. cit.* p. 376.)

Richerand affirms, that, out of twelve popliteal aneurisms, which he has seen in hospital, or private practice, ten were caused by a violent extension of the leg. This statement, he says, will derive confirmation from the following experiment.

Place the knee of a dead subject on the edge of a firm table, and press on the heel, so as forcibly to extend the leg far enough to make the ligaments of the ham snap. Now dissect the parts, cut out the artery, and examine its parietes in a good light, when the lacerations of the middle coat will be observable, and rendered manifest by the circumstance of those places appearing semitransparent, where the fibres are separated, the parietes at such points merely consisting of the internal and external tunics. (*Nosographie Chir. Tom. 4, p. 73, 74, Edit. 2.*) But, the insufficiency of this explanation is clear enough from the fact, that such violence, as is requisite to break the ligaments of the knee, cannot be imagined to happen in the accidents which ordinarily bring on aneurism in the ham.

The implicit belief also which Richerand seems to place in the idea, that the laceration of the middle coat of an artery will bring on an aneurism, while the inner coat is perfect, will appear to be unfounded, when it is remembered, that Hunter, Home, and Scarpa, even dissected off the external and middle coats of arteries, without being able in this manner to cause an aneurism. Nay, where the experiment has been made of applying a tight ligature to an artery, and immediately removing it again in order to determine whether the division of both the inner coats of the vessel would terminate in an obliteration of the tube of the vessel, no aneurism has been the consequence.

Pelletan accounts for the frequency of popliteal aneurisms somewhat differently from Richerand: speaking of the two principal motions of the knee, viz. extension and flexion, he remarks, that the first of these is so limited, that it is actually an incipient flexion, necessarily produced by the curvature backward both of the condyles of the femur, and those of the tibia. This curvature, which would seem to protect the popliteal artery against any dangerous elongation, that might otherwise be caused by a forcible extension of the joint, becomes the very source of such an elongation in persons, who are accustomed to keep their limbs bent, or who, from this state, proceed hastily and violently to extend the leg. The arterial tubes are really shortened, when the limbs are in the state of flexion, and lengthened, when the extension of the members renders it necessary. Hence, says Pelletan, it is manifest, that an habitual shortened state of these vessels, and their

sudden elongation, must be attended with hazard of rupturing their parietes. (*Clinique Chirurgicale, Tom. 1. p. 112.*)

The opinion of Pelletan, however, is quite untenable; because Mr. Hodgson has several times repeated the experiment mentioned by Richerand, and found, as this gentleman did, that the coats of the artery were never lacerated, unless the degree of violence had been such as to rupture the ligaments of the knee. (*On Diseases of Arteries, &c. p. 64.*)

Aneurisms are exceedingly common in the aorta, and they are particularly often met with in the popliteal artery. The vessels, which are next to these the most usually affected, are the crural, common carotid, subclavian, and brachial arteries. The temporal and occipital arteries, and those of the leg, foot, forearm, and hand, are far less frequently the situations of the present disease. But, although it is true, that the larger arteries are the most subject to the ordinary species of aneurisms, the smaller arteries seem to be more immediately concerned in the formation of one peculiar aneurismal disease, now well known by the name of the *aneurism by anastomosis*, of which I shall hereafter speak.

According to surgical writers, the causes of aneurisms operate either by weakening the arterial parietes, or by increasing the lateral impulse of the blood against the sides of these vessels. It is said to be in both these ways, that the disease is occasioned by violent contusions of the arteries, the abuse of spirituous drinks, frequent mercurial courses, fits of anger, rough exercise, exertions in lifting heavy burdens, &c. In certain persons, aneurisms appear to depend upon a particular organic disposition. Of this description was the subject, whose arteries, on examination after death, were found by Lancisi affected with several aneurisms of various sizes. I have known a person have an aneurism of one axillary artery, which disease got spontaneously well, but, was soon afterwards followed by a similar swelling of the opposite axillary artery, which last affliction proved fatal. I have seen another instance, in which an aneurism of the popliteal artery was accompanied with one of the femoral in the other limb. Boyer mentions a patient, who died of a femoral aneurism in la Charité, at Paris, and who had also another aneurism of the popliteal artery, equal in size to a walnut. (*Boyer's Traité des Maladies Chirurgicales, &c. p. 102. T. 2.*) The most remarkable case, however, proving the existence of a disposition to aneurisms in the whole arterial system, is mentioned by Pelletan. "J'ai pourtant vu plusieurs fois ces nombreux aneurismes occupant indistinctement les grosses ou les petites artères, mais surtout celles des capacités: j'en ai compté soixante-trois sur un seul homme, depuis le volume d'une aveline jusqu'à celui de la moitié d'un œuf de poule." (*Clinique Chirurgicale, Tom. 2. p. 1.*)

Aneurisms, and those diseases of the coats of arteries, which precede the formation of aneurism, are much less frequently met with in women than men. (*Lassus Pathologie, Chir. T. 1. p. 348.*) A few years before John Hunter died, Mr. Wilson heard him remark, that he had only met with one woman affected with true aneurism. (*Anatomy, Pathology, &c. of the Vascular System, p. 376.*) Mr. Hodgson drew up the following table, exhibiting the comparative frequency of aneurisms in the two sexes in different cases of this disease, and also in the different arteries of the body, as deduced from examples, either seen by himself during the lives of the patients, or soon after their death.

	Total.	Males.	Females.
Of the ascending aorta, the arteria innominata, and arch of the aorta - -	21	16	5
Descending aorta - - -	8	7	1
Carotid artery - - -	2	2	
Subclavian and axillary -	5	5	
Inguinal artery - - -	12	12	
Femoral and popliteal -	15	14	1
	63	56	7

This table does not include aneurisms arising from wounded arteries, nor aneurisms from anastomosis. (See *Hodgson's Treatise on the Diseases of Arteries and Veins, p. 87.*)

It was observed by Morgagni, and it has been noticed in this country, that popliteal aneurisms occur with particular frequency in postilions and coachmen, whose employments oblige them to sit a good deal with their knees bent. In France, the men who clean out the dissecting rooms, and procure dead bodies for anatomists, are said almost all of them to die of aneurismal diseases. Richerand remarks, that he never knew any of these persons, who were not addicted to drinking, and he comments on the debility, which their intemperance and disgusting business together must tend to produce. (*Nosogr. Chir. T. 4. p. 74, Edit. 2.*)

Aneurisms are supposed by Roux to be much more frequent in England than France; a circumstance, which, before he proves it to be a fact, he vaguely refers to the mode of life, and kind of labour, to which a large part of the population of England are subjected. Indeed, he connects this surmise with a reason for the very cultivated state of this part of knowledge in England, thinks, that we have been placed in favourable circumstances for perfecting the treatment of aneurisms, and acknowledges, that we have contributed more than his countrymen, both in the last and present century, to the improvement of this branch of Surgery. (*Roux Parallele de la Chirurgie Angloise avec la Chirurgie Francoise, &c. p. 249.*) But, ere M. Roux ventured into such conjectures, he ought at least to have specified what particular occupations and

kind of labour are known by Englishmen themselves to be frequently conducive to aneurism, for, with the exception of postilions and coachmen, of whom there are also abundance in France, I am not aware that any determinate class of persons are found in this country to be affected with particular frequency.

In some instances, aneurisms of the axillary artery appear to have arisen from violent extension of the limb. (See the cases recorded by Pelletan in *Clinique Chirurgicale, Tom. 2. p. 49, and 83.*) In other examples, related by the same interesting practical writer, aneurisms arose from reiterated contusions and rough pressure on parts. (*Op. cit. p. 10, P. 14.*)

The extremity of a fractured bone may injure an artery, and give rise to an aneurism, instances of which are recorded by Pelletan, (*Op. cit. Tom. 1. p. 178.*) and Duverney (*Traité des Mal. des os, T. 1.*) In Pelletan's case, the disease followed a fracture of the lower third of the leg. An aneurism of the anterior tibial artery, from such a cause, is also described by Mr. C. White. (*Cases in Surgery, p. 141.*)

The following case of an aneurism of the humeral artery, after amputation, is recorded by Warner: C. D. was afflicted with a caries of the joint of the elbow, which was attended with such circumstances, as rendered the amputation of the limb necessary. The operation was performed at a proper distance above the diseased part, and the vessels were taken up with needles and ligatures.

In a few days the humeral artery became so dilated above the ligature upon it as to endanger its bursting. Hence it was judged necessary to perform the operation for the aneurism, which was done, and the vessel secured by ligature, above the upper extremity of its distended coats. Every thing now went on, for some time, exceedingly well, when suddenly the artery again dilated, and was in danger of bursting above the second ligature. These circumstances made it necessary to repeat the operation for the aneurism. From this time, every thing went on successfully, till the stump was on the point of being healed; when, quite unexpectedly, the artery appeared a third time diseased in the same manner as it had been previously, for which reason, a third operation for aneurism was determined on, and performed.

The last operation was near the axilla, and was not followed by any relapse.

Could the several aneurisms of the humeral artery, (says Mr. Warner) be attributed to the sudden check alone, which the blood met with from the extremity of the vessel being secured by ligature; or is it not more reasonable to suppose, that the coats of the artery, nearly as high up as the axilla, were originally diseased and weakened? The latter, in the opinion of this judicious writer, seems the most probable way of accounting for the successive returns of the disease of the vessel; since it is found from

experience, that such accidents have been very rarely known to occur after amputations, either of the arm, or thigh, where nearly the same resistance must be made to the circulation in every subject of an equal age and vigour, who has undergone such operation.

If it should be supposed, that the several dilatations of the coats of the vessel, continues Mr. Warner, arose merely from the check in the circulation, it will not be easy to account for the final success of this operation; and, especially when we reflect, that the force of the blood is increased in proportion to its nearness to the heart. (See *Cases in Surgery*, p. 139, 140, *Edit.* 4.) Ruysch has related an observation somewhat similar. (*Obs. Anat. Chir. T.* 1. p. 4.)

Aneurisms sometimes follow the injury, which a large artery suffers in gunshot wounds. The passage of a bullet through the thigh, in one example, gave rise to a femoral aneurism. (See the *Parisian Chirurg. Journal*, vol. 2. p. 109.) The same cause produced an aneurism high up the thigh of a soldier, who was under the care of my friend Mr. Collier at Brussels, after the battle of Waterloo.

PROGNOSIS.

In cases of aneurism, the prognosis varies according to a variety of important circumstances. The disease may generally be considered as exceedingly dangerous; for, if left to itself, it almost always terminates in rupture, and the patient dies of hemorrhage. There are on record some examples, however, in which a spontaneous cure took place, and aneurismal swellings have been known to lose their pulsation, become hard, smaller, and gradually reduced to an indolent tubercle, which has entirely disappeared. After death, the artery, in such instances, has been found obliterated, and converted into a ligamentous cord, without any vestige of the aneurism being left. Aneurisms are also sometimes attacked with mortification; the sac and adjacent parts slough away; the artery is closed with coagulum; and thus a cure is effected. Lastly, tumours, having all the character of aneurisms, have been known to disappear under the employment of such pressure, as was certainly too feeble to intercept entirely the course of the blood. Such examples of success, however, are not common, and whenever they happen, it is because the entrance of blood into the sac is prevented by that already contained in it having coagulated, and because the artery above the swelling becomes filled with coagulum. They must, in fact, have been cured on the very same principle, which renders the surgical operation successful.

Nothing is subject to more variety, than the duration of an aneurism previously to its rupture, the tumour bursting sooner or later, according as the patient happens to lead a life of labour; or ease, of intemperance, or moderation. Even the bursting of an internal aneurism may not immediately kill the patient, as the following uncommon instance proves; a stonecutter died in the

hospital Saint Louis with an enormous aneurism, situated on the left side of the lumbar vertebrae. The body was opened by Riche-rand, who found, that the external tumour consisted of blood, which had been effused into a cyst, that was formed in the midst of the cellular substance of the loins. This fluid had passed into the situation specified, by making its way through the muscles. The tract, through which it came, led into another aneurismal sac, contained in the abdomen, and situated behind the peritoneum, on the left side of the lumbar vertebrae. In endeavouring to discover, whence the extravasated blood proceeded, Riche-rand found, that the abdominal aorta was entire, though in contact with the swelling. The original affection consisted of an aneurismal dilatation of the inferior portion of the thoracic aorta, which had burst at the point, where it lies betwixt the crura of the diaphragm. The blood had probably escaped very slowly, and it had accumulated in the cellular substance, which surrounds the kidney, so that three cysts had burst successively, before the patient died. (*Nosogr. Chir. T.* 4. p. 82. *Edit.* 2.)

Every aneurism so situated that it cannot be compressed, nor tied above the swelling, is for the most part absolutely incurable. But, it should be recollected, that sometimes the size of the swelling appears to leave no room for the application of a ligature above it, while things are in reality otherwise, in consequence of the communication between the sac and the artery, bearing no proportion to the magnitude of the tumour itself. At the present day, also, enlightened by anatomical knowledge, and encouraged by successful experience, surgeons boldly follow the largest arteries, even within the boundaries of the chest and abdomen, as we shall presently relate, and numerous facts have now proved, that few external aneurisms are beyond the reach of modern surgery. It being certain, that aneurisms cannot commonly be cured, except by an obliteration of the affected artery, it follows, that the circulation must be carried on by the superior and inferior collateral branches, or else the limb will mortify. Experience proves, that the impediment to the passage of the blood, through the diseased artery, obliges this fluid to pass through the collateral branches, which gradually acquire an increase of size. It is therefore a common notion, that it must be in favour of the success of the operation, if the disease be of a certain standing; and in direct opposition to the sentiments of Kirkland, Boyer even asserts, that the most successful operations have been those performed on persons, who have had the disease a long while. (*Traité des Maladies Chirurg. T.* 2. p. 116.)

There is this objection to delay, however, that the tumour becomes so large, and the effects of its pressure so extensive and injurious, that, after the artery is tied, great inflammation, suppuration, and sloughing, often attack the swelling itself, and the patient falls a victim to what would not have

occurred, had the operation been done sooner.

The large size of an aneurism, as Mr. Hodgson has rightly observed, is a circumstance, which materially prevents the establishment of a collateral circulation. When the tumour has acquired an immense bulk, it has probably destroyed the parts, in which some of the principal anastomosing branches are situated; or by its pressure it may prevent their dilatation. (See *Hodgson on the Diseases of Arteries and Veins*, p. 259.) The practice of permitting an aneurism to increase, that the collateral branches may become enlarged, (says this gentleman) is not only unnecessary but injurious, inasmuch as that the increase of the tumour must be attended with a destruction of the surrounding parts, which will render the cure of the disease more tedious and uncertain. (P. 266.)

The most successful operations, which I have seen, were performed before the aneurismal swellings were very large. However, notwithstanding the great disadvantages of letting the swelling become bulky before the operation, the fact appears scarcely yet to have made due impression, and surgeons are yet blinded with the plausible scheme of giving time for the collateral vessels to enlarge: at least, I infer, that things are so, from having lately seen a patient, who had been advised to let the operation be postponed on such a ground, though the swelling in the ham was already as large as an egg.

The surgeon should not be afraid of operating, although appearances of gangrene may have taken place on the tumour; for, as Mr. Hodgson remarks, should it burst afterwards, it is probable, that both extremities of the artery in the sac will be closed with coagulum. (*Hodgson*, p. 305.) Mr. A. Cooper tied the external iliac artery in two cases of inguinal aneurism, when gangrene existed, and though the tumours burst, no hemorrhage ensued. The coagulum was discharged; the sac granulated; and the sores gradually healed. (*Medico Chir. Trans.* Vol. 4. p. 431.)

The effects of the pressure of aneurisms upon the bones, are justly regarded as an unpleasant complication, when they take place in an extensive degree, and, according to writers, they may sometimes induce a necessity for amputation. (*Boyer, Traité des Mal. Chir. t. 2. p. 117.*) However, I have never seen a case of this description; and Mr. Hodgson, as we have already explained, informs us, that the affection of the bones is hardly ever attended with exfoliations, or the formation of pus, so that if the aneurism can be cured, the bones will recover their healthy state, without undergoing those processes which take place in the cure of caries, or necrosis. (*On Diseases of Arteries and Veins*, p. 80.) At the same time, there can be no doubt, that where the tumour has been allowed to attain a large size, before an attempt is made to cure it, and where, from this cause, both the neighbouring soft parts and the

bone have suffered considerably, the completion of a cure, that is to say, the full restoration of the use of the limb, must be far more distant than in other cases, where the cure is attempted in an earlier stage. Here, then, we see another reason against the pernicious doctrine of waiting for the enlargement of the anastomosing vessels, in addition to that which has been urged in the previous column.

The age, constitution, and state of the patient's health, are also to be considered in the prognosis; for they undoubtedly make a great difference in the chance of success after the operation.

The operation, however, should not be rejected on account of the age of the patient, if the circumstances of the case in other respects appear to demand it; for it has often succeeded at very advanced periods of life. "I have seen several aneurisms cured by the modern operation, in patients above sixty years of age." (*Hodgson*, p. 304.) A fact to which my own opportunities of observation enable me also to bear witness.

When an aneurism exists in the course of the aorta, the violent action of the heart, excited by an operation in the extremities, may cause it to burst, and prove instantaneously fatal. Two cases have recently occurred in this metropolis, in which the patients died from such a cause during operations for popliteal aneurisms. (See *Hodgson on Diseases of Arteries*, p. 306. *London Med. Review*, vol. 2. p. 240. and *Burns on Diseases of the Heart*, p. 226.) Were the coexistence of the internal aneurism known, the operation for the other tumour would be improper, and the surgeon should limit the treatment to palliative means.

Experience confirms, however, that the circumstance of there being two aneurisms in the limbs should not prevent the operation, which is to be practised at separate periods. Facts in support of this statement are quoted by Mr. Hodgson. (P. 310.)

OF THE SPONTANEOUS CURE, AND GENERAL TREATMENT OF ANEURISMS.

The obliteration of the sac, in consequence of a deposition of lamellated coagulum in its cavity, as Mr. Hodgson has well described, is the mode by which the spontaneous cure of aneurism is in most instances effected. The blood soon deposits upon the inner surface of the sac a stratum of coagulum; and successive depositions of the fibrous part of the blood by degrees lessen the cavity of the tumour. At length, the sac becomes entirely filled with this substance, and the deposition of it generally continues in the artery on both sides of the sac as far as the giving off of the next large branches. The circulation through the vessel is thus prevented; the blood is conveyed by collateral channels; and another process is instituted, whereby the bulk of the tumour is removed. (*Hodgson on the Diseases of Arteries, &c.* p. 114.) Such desira-

the increase of the coagulated blood in the sac is indicated by the tumour becoming more solid, and its pulsation weak, or ceasing altogether.

Another mode in which the disease is spontaneously cured, happens as follows: an aneurism is sometimes deeply attacked with inflammation and gangrene; a dense, compact, bloody coagulum is formed within the vessel, shutting up its canal, and completely interrupting the course of the blood into the sac. Hence the sphacelation which follows, and the bursting of the integuments and aneurismal sac, are never accompanied by a fatal hemorrhage; and the patient is cured of the gangrene and aneurism, if he has strength sufficient to bear the derangement of the health necessarily attendant on so considerable an attack of inflammation and gangrene.

When a patient dies of hemorrhage, after the mortification of an aneurism, it is because only a portion of the integuments and sac has sloughed, without the root of the aneurism, and especially the arterial trunk, being similarly affected. For cases illustrative of this statement, refer to *Hodgson on Diseases of Arteries*, p. 103, &c.

A third way, in which an aneurism may be spontaneously cured, is by the tumour compressing the artery above, so as to produce adhesion of its sides, and obliteration of its cavity. This mode of cure must be uncommon: it has been adverted to by Sir E. Home, Scarpa, Dr. John Thomson, and others; but some facts, tending to prove it, have been collected by Mr. Hodgson, and are published in his useful work. (See p. 107, &c.)

"The surgical treatment of aneurism (says this gentleman,) consists in the obliteration of the cavity of the artery communicating with the sac, so that the ingress of the blood into the latter is either entirely prevented, or the stream which passes through it is supplied only by anastomosing branches, and consequently the force of the circulation is so much diminished, that the increase of the tumour is prevented, and the deposition of coagulum is promoted. By the absorption of its contents, and the gradual contraction of the sac, the cure is ultimately accomplished. The blood is conveyed to the parts, which it is destined to supply, by collateral vessels, some of which being gradually enlarged, constitute permanent channels for the circulation. The obliteration of the artery is effected by the excitement of such a degree of inflammation in its coats, as shall produce adhesion of its side. These objects have been attempted by the compression or the ligation of the artery. The latter method constitutes the operation for aneurism." (P. 165.)

According to Scarpa, a complete cure of an aneurism cannot be effected, in whatever part of the body the tumour is situated, unless the artery, from which the aneurism is derived, be, by nature or art, obliterated and converted into a perfectly solid, ligamentous substance,

for a certain extent above and below the place of the ulceration, laceration, or wound. When aneurisms are cured by compression, the cure is never accomplished, as some have supposed, by the pressure strengthening the dilated proper coats of the artery, and restoring, especially to the muscular coat, the power of propelling the blood along the tube of the artery, as it did previously to its supposed dilatation. M. Petit, and Foubert, thought, that the natural curative process sometimes consisted in a species of clot, which closed the laceration, ulceration, or wound of the artery, and resisted the impulse of the blood, so as still to preserve the continuity of the coats of the artery, and the pervious state of the vessel. Haller imbibed a similar sentiment, from experiments made on frogs.

If the foregoing statement of Scarpa, respecting the obliteration of the tube of the adjacent portion of the artery, when an aneurism is cured, had been delivered merely as what is the most common course of things, it would not have been incorrect; but when he denies the possibility of the calibre of the vessel being ever preserved, whether the disease be cured by art or nature, he is exceeding the bounds of accuracy.

Notwithstanding aneurisms cannot in general be cured, as Scarpa has explained, unless the artery be rendered impervious for some extent above and below the tumour, I believe we must make an exception to this observation with respect to the few aneurisms of the aorta (especially those of its arch,) which, according to the records of surgery, have been diminished and cured by Valsalva's treatment. In such examples, we are not to suppose that the aorta becomes obliterated at its very beginning; but that the diminution of the quantity of circulating blood, the reduced impetus of this fluid, the lessened distention of the aneurismal sac, the general weakness induced in the constitution, and the increased activity of the lymphatic system, all necessary effects of Valsalva's method, have combined to bring about a partial subsidence of the tumour.

"It is a common opinion (says Mr. Hodgson,) that the radical cure of an aneurism cannot take place, without the obliteration of the artery, from which the disease originates. It is probably owing to this idea, that aneurisms of the aorta have generally been considered as incurable diseases, and consequently that so little attention has been given to their treatment." (P. 118.) The facts, however, which this gentleman has related, satisfactorily prove, 1st. That a deposition of coagulum may take place in an aneurismal sac, to such an extent as entirely to preclude the communication between its cavity and that of the artery from which it originates. Secondly, that a sac, thus filled with coagulum, cannot prove fatal by rupture; and thirdly, that the gradual absorption of its contents, and the consequent contraction of the sac, may proceed

to such an extent as to effect the cure of the disease, without any obstruction taking place in the calibre of the vessel from which it originates. See cases 20, 21, 22, &c. (*Hodgson on Diseases of the Arteries, &c. p. 119, &c.*) In support of this doctrine, some facts are also cited from Corvisart. (*Essai sur les Maladies de Cœur, p. 313, &c.*)

A part of these cases, it is true, are not viewed exactly in this light by Kreysig, who argues (as I think without much probability,) that they might have been only adipose swellings connected with, or formed in the parietes of the artery, a disease described by Stenzel. (*German Transl. of Mr. Hodgson's Book, p. 174.*)

That a punctured artery may occasionally be healed in this manner, Scarpa himself proves, by a case which he examined, where an aneurism took place from the wound of a lancet in bleeding. In the article *Hemorrhage*, we shall see, that Jones's experiments show the same thing, and the particular circumstances in which it may happen. But the occurrence is rare, and Scarpa says, that it can hardly be called a radical cure, as the cicatrix is always found in a state ready to burst and break, if the arm is, by any accident, violently stretched or struck where the wound was situated.

In the spontaneous cure of aneurisms, arising from arteries of inferior size to that of the aorta, repeated examinations have proved, that the deposition of coagulum does not in general merely fill up the sac, but obliterates the tube of the artery above and below the disease to the next important ramifications. Yet, even here, exceptions probably take place; for Mr. Hodgson has brought forward one instance, in which a small sac, which originated from the anterior artery of the cerebrum, was completely filled with firm coagulum, which did not extend into the cavity of the vessel. (*On Diseases of Arteries, p. 132.*) And he reports the particulars of a true femoral aneurism, communicated to him by Mr. A. Cooper, in which, after the patient's death, the femoral artery was found dilated into a sac, which was lined on all sides with very firm layers of coagulum, in the centre of which was an irregular canal, through which the circulation was continued. As the inside of this canal presented a membranous appearance, it was inferred that the aneurism had been cured. (*Op. cit. p. 134.*) Here I may be permitted to remark, that if this case be correctly reported, viz. if it were a true aneurism by dilatation of all the arterial coats, and the inside of it was every where lined by firm layers of coagulum, it amounts to a proof that such a deposition is not entirely confined to aneurisms by rupture, as Scarpa supposes. And, in addition to this fact, I may mention, as referring to the same question, a case of aneurism from dilatation of the arterial coats, observed by Guattani, where the same process took place. "*Arteriæ iliacæ ovalem hanc partem aneurysmaticam polyposa substantia variæ densitatis adeo infarctam esse denotebam, ut tuni-*

carum ejusdem forma penitus destructa in uniformem massam, spongiæ cera imbutæ similem, transformata videretur." (*Hist. 17. Collect. Lauth, p. 158.*)

Whenever the ulcerated, lacerated, or wounded artery is accurately compressed against a hard body, like the bones, it ceases to pour blood into the surrounding cellular sheath, because its sides, being kept in firm contact, for a certain extent above and below the breach of continuity, become united by the adhesive inflammation, and converted into a solid, ligamentous cylinder. Molinelli, Guattani, and White, have given examples and plates illustrative of this fact. When aneurisms get well spontaneously, the same fact is observed after death, as Valsalva, Ford, &c. have demonstrated. I have myself seen, in St. Bartholomew's hospital, an instance in which a man had had a spontaneous cure of an aneurism in the left axilla, but afterwards died of hemorrhage from another aneurismal swelling under the right clavicle: the artery on the left side was found completely impervious. My friend, Mr. Albert, had under his care, in the York Hospital, Chelsea, a dragoon, who recovered spontaneously of a very large aneurism of the external iliac artery: the tumour sloughed, discharged about two quarts of coagulated blood, and then granulated and finally healed up. Paoli relates a similar termination of a popliteal aneurism. Moynichen and Guattani relate other examples. Hunter found the femoral artery quite impervious, and obliterated, at the place where a ligature had been applied fifteen months before. Boyer noticed the same fact in a subject eight years after the operation. Petit describes the spontaneous cure of an aneurism at the bifurcation of the right carotid: the subject having afterwards died of apoplexy, the vessel, on dissection, was found closed up and obliterated from the bifurcation, as far as the right subclavian artery. Desault had an opportunity of opening a patient, in whom a spontaneous cure of a popliteal aneurism was just beginning: he found a very hard, bloody thrombus, which extended for three finger-breadths, within the tube of the artery, above the sac, and was so firm, as to resist injection, and make it pass into the collateral branches.

Both the spontaneous and surgical cures of aneurisms have generally two stages: in the first, the entrance of the blood into the aneurismal sac is interrupted; in the second, the parietes of the artery approach each other, and, becoming agglutinated, the vessel is converted into a solid cylinder. This doctrine is corroborated by the tumour first losing its pulsation, and then gradually diminishing and disappearing.

In order that compression may make the opposite sides of an artery unite, and thus produce a radical cure of an aneurism, Scarpa says, the degree of pressure must be such as to place these opposite sides in firm and complete contact, and such as to excite the adhesive inflammation in the coats of the

artery. The point of compression must also fall above the laceration or wound of the artery; for when it operates below, it hastens the enlargement of the tumour; and Scarpa adds, that in practice, bandages which are expulsive and compressive are more useful for making pressure than any tourniquets or instruments, many of which are contrived to operate, without retarding the return of blood through the veins.

In order that pressure may succeed, the coats of the vessel, at the place where it is made, must be sufficiently free from disease to be susceptible of the adhesive inflammation. When the arterial coats, round the root of the aneurism, are much diseased, Scarpa considers them as insusceptible of the adhesive inflammation, although compressed together in the most scientific manner, and, even when tied with a ligature, which only acts by making circular pressure on the vessel.

This statement would appear to derive confirmation from the following fact: Mr. Langstaff amputated the thigh of a person seventy-five years of age; but the vessels were so ossified, that they could not be effectually tied, and the patient died within twenty-four hours. It is generally supposed, says Mr. Lawrence, that this condition of the arterial coats is incompatible with their union under the application of the ligature. The opinion should be received, however, with some limitation. In a man fifty-nine years of age, bleeding took place nearly a month after amputation, from the ossified femoral artery, and Mr. Lawrence was therefore obliged to expose and tie that vessel again for the suppression of the hemorrhage, when he found a hard tube, which cracked immediately the ligature was tightened: the bleeding, however, never returned. (See *Med. Chir. Trans. Vol. 6, p. 193.*) This case is mentioned, however, not with any view of encouraging surgeons to apply ligatures round diseased portions of arteries, a thing which should always be avoided when possible, but to let them be aware, that an ossified artery is sometimes susceptible of being permanently closed, when a ligature is put round it. With respect to Scarpa's idea of making pressure operate so as to place the two opposite parietes of the artery at the mouth of the aneurismal sac, completely in contact, in order that they be united by the adhesive inflammation, and the cavity of the vessel be obliterated, I should think with Mr. Hodgson, that if pressure will succeed only under these circumstances, it will answer very seldom, because, in almost all aneurismal sacs, a sufficient deposition of coagulum will have taken place to prevent the possibility of placing the opposite sides of the artery at the mouth of the aneurism in a state of complete contact. (*On Diseases of Arteries, &c. p. 172.*) Possibly, however, Scarpa's directions refer to a point of the vessel, rather beyond the usual limits of the laminated coagula; and he is particular in recommending the practice only where the aneurism is soft and small.

Some advise trying compression in every case of aneurism, whether small, circumscribed, soft, flexible, indolent, or elevated, diffused, hard, and painful. But, in the latter case, Scarpa represents compression as decidedly hurtful. He says also, that every bandage which compresses the aneurism, and also circularly constricts the affected part, is always injurious. The bandage, likewise, which compresses only the aneurism, and directs the point of pressure below the rupture in the vessel; that which, on account of the great size, exquisite sensibility, depth of the root of the aneurism, and fleshy state of the surrounding parts, cannot effectually compress the artery against the bones, so as to bring the opposite side of the vessel into contact; and, lastly, the compression applied to a spontaneous aneurism, attended with a steatomatous, ulcerated, earthy disease of the arterial coats, ought to be considered as more likely to do harm than benefit. In cases of a completely opposite description, bandages have produced, and may produce, a radical cure, and should not be entirely disused. (*Scarpa, on Aneurism, ed. 2. p. 221.*)

Guattani first employed compression systematically for the cure of aneurisms, and out of fourteen cases in which he adopted the plan, four were cured by it. Mr. Freer details other examples; but, in general, pressure has hitherto been applied to the tumour itself, a method less likely to answer than that of making pressure on a sound part of the artery. Mr. Freer recommends the employment of Sennio's instrument, or the following method: first place a bandage, moderately tight, from one extremity of the limb to the other; then put a pad upon the artery, a few inches above the tumour; next, surrounding the limb with a tourniquet, let the screw be fixed upon the pad, having previously secured the whole limb from the action of the instrument, by a piece of board wider than the limb itself, by which means the artery only will be compressed, when the screw is tightened. The tourniquet should now be twisted till the pulsation in the tumour ceases. In a few hours the limb will become œdematous and swelled, when the tourniquet may be removed, and the pressure of a pad and roller will afterwards be enough. By experiments which this gentleman made on the radial arteries of horses, these vessels were found to become inflamed, and to be rendered impervious by such a process. (*Freer, p. 112.*) In a modern work, Dubois is stated to have cured an aneurism of the thigh by steady pressure on the vessel for twenty-four hours. (*Med. Chir. Trans. vol. 4. p. 437.*)

Mr. A. Cooper describes another machine for compressing the femoral artery, in cases of popliteal aneurism: it was used by Sir W. Blizard.

"The points of support for this instrument, were the outer part of the knee, and the great trochanter, a piece of steel passing from one to the other; and to the mid-

die of this a semicircular piece of iron was fixed, which projected over the femoral artery; having a pad at its end, moved by a screw, by turning which, the artery was readily compressed, and the pulsation in the aneurism stopped, without any interruption to the circulation in the smaller vessels." But although the patient on whom it was tried possessed unusual fortitude, he was incapable of supporting the pressure of the instrument longer than nine hours. (*Med. and Phys. Journal*, vol. 8.) Few patients, indeed, can endure the pressure of such instruments a quarter of this time, when they are put on sufficiently tight to afford any chance of obliterating the artery; and, on account of the suffering which they produce, they are rarely used by modern surgeons.

Whenever the treatment by pressure is attempted, the plan should be assisted with repeated bleedings, spare diet, and perfect quietude in bed. Digitalis has also been sometimes prescribed, with the view of lessening the impetus of the circulation. It is likewise a favourite plan with some practitioners, to apply snow, or powdered ice to the tumour, as I shall notice in describing Valsalva's treatment of aortic aneurisms. These last applications have been employed for the purpose of promoting the coagulation of the blood within the aneurismal sac, and the consequent obliteration of the cavity of the aneurism and the artery. Various examples, in which it has been thought to have produced a cure, are recorded by Guérin. (*Réveil Périod. de la Soc. de Santé de Paris*, No. 3, *Pelletan Clinique Chir. and Ribes, Bulletins, de la Faculté de Méd. de Paris*, 1817, No. 1. and 2. p. 284.) The employment of ice, however, is not considered proper in every case. Breschet says, that, when the swelling is large, the parts very tense, their texture changed, and the skin thin, the practice is likely to accelerate the formation of a slough; and he confirms a remark made by Mr. Hodgson, that some patients cannot continue this treatment longer than a few minutes, while others find it absolutely insupportable. (*Fr. Transl. of Mr. Hodgson's Work*, t. 1. p. 212—229.)

The grand means, most to be depended upon, for curing aneurisms, is tying the artery above the tumour. This more certainly prevents the great ingress of blood into the sac, and, what is more important, more certainly excites the adhesive inflammation within the tied part of the vessel, and, by holding the opposite sides of it steadily in contact, brings about their union, and an obliteration of the tube of the vessel, with tolerable regularity. The chief current of blood into the sac is thus stopped, the contents of the aneurism are afterwards gradually absorbed, and the tumour dwindles away in proportion. The natural course of the blood being now permanently interrupted in the arterial trunk, it passes more copiously into the collateral branches, and these enlarging and anastomosing with others, which originate from the large arte-

ries beyond the obstruction, the necessary circulation is carried on. (See *Anastomosis* and *Inosculation*.)

The ligature of the superficial femoral artery, may be performed with the same confidence of success, as the ligature of the brachial artery, that is, without any fear of destroying the circulation, or depriving the subjacent limb of its vitality. Indeed, the numerous and conspicuous anastomoses, which are met with all round the knee, correspond exactly with those which are observed round the elbow, and at the bend of the arm. This is not a peculiarity of the arteries of the extremities, but it is a general rule which nature has followed in the distribution of all the arteries, that the superior trunks communicate with the inferior, by means of the lateral vessels. After the principal trunk of an artery is tied, its lateral branches not only carry on the circulation in the parts below the ligature, but do so with greater quickness and activity than they did previously, while the course of the blood was unimpeded through the principal trunk. This evidently arises from the increased determination of blood into the lateral vessels, as well as from the enlargement of the diameter of these vessels. After the amputation of the thigh, while the blood flows in a full stream from the superficial femoral artery, very little or no blood is poured out of the lateral vessels; but as soon as that artery is tied, the blood issues with impetuosity from the small arteries, which run along, within the vasti and crureus muscles; and on these smaller arteries being also tied, the blood immediately oozes out from the minute arterial vessels of the muscles and cellular membrane. When the principal trunk of an artery is tied, its lateral branches gradually acquire a much larger diameter. After amputation of the thigh, on account of a popliteal aneurism, the size and situation of which could not fail materially to impede the course of the blood through the trunk of the femoral artery, it has been often remarked, that, although both the trunk and the greater and smaller branches had been tied with the greatest accuracy, the patients have been in danger of losing their lives, on account of the repeated copious hemorrhages from the innumerable small lateral vessels that had become unusually enlarged. In several cases, during the treatment, and especially after the radical cure of popliteal aneurism, by tying the superficial femoral artery, in the upper third of the thigh, all the ramifications of the recurrent popliteal arteries have been felt beating strongly round the knee. We have already noticed, that Boyer found, in a man who some years previously had been operated on for a popliteal aneurism, but had afterwards died from a caries of the tibia, that an arterial branch, which runs in the substance of the sciatic nerve, was dilated so much, as to be equal in diameter to the radial artery. White, in dissecting the arm of a lady, who, fifteen years before, had been operated on for an aneurism in the

band of the arm, found the brachial artery obliterated, and converted into a solid cylinder, for three inches below the place of the ligature, and as far as the division into the radial and ulnar arteries; but the recurrent radial and ulnar branches had become so much enlarged, that, taken together, they exceeded the size of the brachial artery, above the situation of the ligature. In the dead body it is found, that an anatomical injection will pass more freely from one extremity to the other of an aneurismatic, than of a sound limb, and this even when no vessels are visibly enlarged. Although it be self-evident, that the circulation through the collateral vessels ought to be much more easy and quick the lower down the ligature is applied to the principal trunk; yet experience shows, that this difference is not to be estimated very high; for in cases of popliteal aneurism, *ceteris paribus*, the success is the same, whether the femoral artery be tied very low down, or very high up in the thigh. (Scarpa.)

This facility of the passage of the blood through the lateral vessels, is not the same in subjects of all ages; and, in the same subject, it is not the same in the inferior, as in the superior extremity. An age under forty-five; and the operation being done on the arm, which is nearer the source of the circulation, than the lower extremity, increases the chance of success. However, notwithstanding these are the opinions of Scarpa, and as general ones may not be incorrect, surgeons in England now operate for aneurisms of the lower extremity, and on patients much older than forty-five, with a degree of confidence, which nothing but great success could inspire.

According to Scarpa, the circumstances chiefly preventive of success, especially in the popliteal and femoral aneurisms, are the following: rigidity, atony, or disorganization of the principal anastomoses, between the superior and inferior arteries of the ham and leg; sometimes depending on an advanced age, or on it, together with the large size of the aneurism, which, by long continued pressure, has caused a great change in the neighbouring parts; or sometimes on steatomatous, ulcerated, earthy, cartilaginous disorganization of the proper coats of the artery, not confined to the seat of the rupture, but extending a great way above and below the aneurism, and also to the principal popliteal recurrent arteries, tibial arteries, and, occasionally, to portions of the whole track of the superficial femoral artery. Sometimes the pressure of large aneurisms renders the thigh bone carious. In such circumstances, the ligature is apt to fail in closing the trunk of the artery; and, if it should succeed, the state of the anastomosing vessels will not admit of a sufficient quantity of blood being conveyed into the lower part of the limb. Hence, when the patient is much advanced in life, languid, and sickly; when the internal coat of the artery is rigid, and incapable of being united by a ligature; when the aneurism is of long

standing, and considerable size, with caries of the os femoris, or tibia; when the leg is weak and cold, much swelled, heavy, and cedematous; Scarpa considers the operation contra-indicated. I must, however, declare in this place, that I have seen very large aneurisms, as well as aneurisms in persons of advanced age, cured by the Hunterian plan, in St. Bartholomew's Hospital; and, with respect to the affection of the bones, though it may be an unfavourable circumstance, its consequences are not so serious as those of ordinary caries, as I have already explained.

It appears, then, that the obliteration of the artery, for a certain extent above and below the place of rupture, forms the primary indication in the radical cure of aneurism, whether compression or the ligature be employed; all other means are only auxiliary. Internal remedies may be useful, inasmuch as they tend to moderate the determination of the blood towards the place, where the artery has been tied or compressed.

In the articles *Hemorrhage*, and *Ligature*, I have related in detail the effects of the ligature upon a tied artery, and particularly the various processes which arise from its application, and terminate in the permanent obliteration of the vessel. In the same places, I have explained what are the best ligatures for use, as well as the safest manner of using them. Confining myself in the sequel of this article, to what expressly relates to aneurism, I shall here merely annex the following general directions, as stated by Mr. Hodgson.

First, The cord should be thin and round, such a ligature being most likely to effect a clean division of the internal and middle coats of the vessel, and not liable to occasion extensive ulceration or sloughing.

Secondly, The ligature should be tight, in order to ensure the complete division of the internal and middle coats, and to prevent its detachment, it being almost impossible, even with the thinnest ligature, entirely to cut through a healthy artery.

Thirdly, the vessel should be detached from its connexions only to such an extent as is necessary for the passage of the ligature underneath it.

Fourthly, The immediate adhesion of the wound should be promoted by all such means as are known to promote that process in general. (*On the Diseases of Arteries*, p. 225, 226.)

In the course of his experiments upon brutes, to ascertain the operation of the ligature, Dr. Jones arrived at a fact, which offered the probability of leading to an improvement in the operation for aneurism. (*Treatise on Hemorrhage*, chap. 3.) When a small firm ligature is applied to an artery, it causes a division of the internal and middle coats; and if it be afterwards removed, an effusion of lymph takes place between the cut surfaces into the cavity of the vessel. If several divisions of the internal and middle coats be thus affected in the vicinity of each other, the effusion of lymph was

found by Dr. Jones to be sufficiently extensive to obliterate the cavity of the vessel. In the year 1800, Mr. C. Hutchinson tied the brachial arteries of two dogs, and removed the ligatures immediately after their application: in both instances, as he assures us, the complete obliteration of the canal of the artery was the consequence of the operation. (See *his Practical Observations in Surgery*, p. 103.) If immediately after the operation for aneurism, the ligature could be removed, and yet the vessel become obliterated, it would be highly advantageous, as there would then be left in the wound no extraneous substance to prevent its union, or promote secondary hemorrhage by extending the sloughing, or ulcerative process too far. It is to be regretted, that success has not attended the repetition of the experiment by others. Mr. Hodgson tried it, but the artery did not become impervious. (See *Experiments*, A. & B. p. 228, 229, of this gentleman's work.) Mr. Dalrymple, of Norwich, made the experiment not less than seven times on the horse, and three times on sheep, and failed in every instance in obtaining the same result as Dr. Jones. Not only was no coagulum formed, but, even where the animal had been suffered to live until the thirteenth, fifteenth, and eighteenth days after the operation, the canal of the artery was not found obliterated. In every instance, indeed, its calibre was contracted; but it was still capable of transmitting a lessened column of blood. (*Travers, in Med. Chir. Trans. Vol. 4*, p. 442.) Thus, it appears, that an effusion of lymph is an invariable consequence of the operation, and as Mr. Travers has observed, the want of union is therefore owing to the opposite sides of the vessel not being retained in a state of contact, so as to allow of their adhesion. The presence of the ligature, in the common mode of its application, effects this object; and for the success of Dr. Jones's experiment, it appeared only necessary, that the opposite sides of the wounded vessel should be retained in contact, until their adhesion was sufficiently accomplished to resist the passage of the blood through the tube. This object might probably be effected by compression; but, the inconveniences attending such a degree of pressure, as would retain the opposite sides of an artery in contact at the bottom of a recent wound, are too great to permit its employment. It occurred to Mr. Travers, that if a ligature were applied to an artery, and suffered to remain only a few hours, the adhesion of the wounded surfaces would be sufficiently accomplished to ensure the obliteration of the canal; and by the removal of the ligature at this period, the inconveniences attending its stay would be obviated. The danger produced by the residence of a ligature upon an artery, arises from the irritation, which, as a foreign body, it produces in its coats. Ulceration has never been observed to commence in less than twenty-four hours after the application of a ligature; whilst it

is an ascertained fact, that lymph is in a favourable state for organization in less than six hours, in a wound the sides of which are preserved in contact. (*Jones, chap. 4, exp. 1.*) If it be sufficient, therefore, to ensure their adhesion, that the wounded coats of an artery be kept in contact by a ligature only three or four hours, ulceration and sloughing may in a great degree be obviated by promoting the immediate adhesion of the wound. Justified by this reasoning, Mr. Travers performed several experiments, by which he ascertained, that if a ligature were kept six, two, or even one hour upon the carotid artery of a horse, and then removed, the adhesion was sufficiently advanced to effect the permanent obliteration of the canal. It appeared probable, that the same result would be obtained upon the healthy artery of a human subject. (See *Travers's Obs. in Med. Chir. Trans. Vol. 4*, and *Hodgson's Treatise on the Diseases of Arteries and Veins*, p. 228, et. seq.)

Mr. A. Cooper appears to have performed one operation for a popliteal aneurism, with a view of ascertaining the efficacy of such a method on the human subject. He completely stopped the flow of blood for thirty-two hours, and then removed the ligature; but the pulsations of the tumour commenced again. He next applied the ligature for forty hours longer, at the end of which time, no pulsation recurred on the ligature being taken away. On the twelfth day, however, a considerable bleeding took place, and it was necessary to take up the vessel anew.

Mr. A. C. Hutchinson has tried this method, as modified by Mr. Travers, in an operation, which he performed for a popliteal aneurism in a sailor, in Nov. 1813. A double ligature was passed under the femoral artery. The ligatures were tied with loops, or slip-knots, about a quarter of an inch of the vessel being left undivided between them. All that now remained of the pulsation in the tumour, was a slight undulatory motion. Nearly six hours having elapsed from the application of the ligatures, the wound was carefully opened, and the ligatures untied and removed, without the slightest disturbance of the vessel. In less than half a minute afterwards, the artery became distended with blood, and the pulsations in the tumour were as strong as they had been before the operation. Mr. Hutchinson then applied two fresh ligatures; hemorrhage afterwards came on; amputation was performed, and the patient died. (*See Practical Observations in Surgery*, p. 102, &c.) Now, as Mr. Hutchinson chose to apply other ligatures, on finding that the pulsation returned, the above case only proves, that the artery is not obliterated in about six hours, and we are left in the dark respecting the grand question, namely, whether the vessel would have become obliterated by the effusion of coagulating lymph and the adhesive inflammation, notwithstanding the return of circulation through it. As for the hemorrhage which occurred, I think it might have been expected, considering the dis-

turbance and irritation, which the artery must have sustained in the proceedings absolutely necessary for the application of not less than four ligatures, and the removal of two of them. According to my ideas, only one ligature ought to have been used, and none of the artery detached. We also have no description of the sort of ligatures, which were employed; an essential piece of information in forming a judgment of the merits of the preceding method. The application, removal, and reapplication, of ligatures are not consistent with the wise principles inculcated by the late Dr. Jones, and have, in more instances than that recorded by Mr. Hutchison, brought on ulceration of the artery and hemorrhage.

The limits of this work prevent me from entering into the particulars of the very interesting experiments, undertaken by Mr. Travers, upon the arteries of animals, for the purpose of ascertaining the earliest period when a ligature might be removed from an artery, without any risk of the vessel not being duly obliterated. A full detail of them may be seen in another work, (See *Med. Chir. Trans. Vol. 4 and 6*;) and others in relation to the same question may likewise be perused in Scarpa's appendix to his great work on aneurism. (*Memoria sulla Legatura delle principali Arterie degli Arti, &c. Fol. Pavia, 1817.*) The cases, above related, and other considerations, long ago satisfied me, that, flattering as the suggestion of Dr. Jones was, the plan of removing the ligature, previously to its natural separation, would never answer in the operation for the cure of aneurism, unless either an obliteration of the arterial tube would follow with reasonable certainty the taking away of the ligature directly after it had been applied, and it had divided the inner coats of the vessel; or, at all events, unless the ligature could be withdrawn at a determinate period, when either the same obliteration would surely ensue, or be already complete; and, all this, with such regularity and infallibility in every case, that the surgeon would have no chance of being called upon to apply another ligature, do a second operation, or disturb the artery in any kind of way whatsoever.

Mr. Travers, in the prosecution of this inquiry, in which he has evinced a full determination to be guided by no motive, but the love of truth, at length tried the temporary application of the ligature in a case of brachial aneurism, which he operated upon Feb. 14, 1817. The artery was tied an inch and a half above the bend of the elbow with a noose ligature. The pulsation in the radial artery immediately ceased. On the 16th, at four o'clock in the afternoon, the ligature was removed with little difficulty after having remained on the artery *fifty hours*. No pulsation ensued in the vessel below the point where the ligature had been applied, and the case was completely successful.

On the 28th November, 1817, in a case of popliteal aneurism, Mr. Travers tied the fe-

moral artery at one o'clock. On the 29th, at four in the afternoon, the ligature was removed without difficulty, after having been on the vessel *twenty-seven hours*. At this period, no pulsation could be felt in the sac; but, at seven in the evening a faint pulsation was perceptible. On the 30th, the pulsation, though very distinct, was less strong, than before the operation. On the 2d, 3d, and 6th of December, the pulsation is described as still continuing. On the latter day, pressure was applied by means of a roller from below the knee to the groin, and was continued for a month, during which time the pulsation in the sac evidently became more feeble. On the 10th of January, the tumour became tense, and severely painful, and no pulsation in it could be distinguished. The next day, the swelling was more diffused and less prominent; and on the 12th, as the disease underwent no amendment, Mr. Travers tied the artery again, about two inches above the place, where the former ligature had been applied. The next day, the pain had diminished. The ligature was afterwards allowed to separate of itself; and the case went on favourably to the cure. According to Mr. Travers, the first of these cases tends to prove, that *the continuance of the ligature upon the artery, for a period of fifty hours*, as certainly and completely answers the purpose of its application, as if allowed to remain until thrown off by the natural process.

In the second case, Mr. Travers infers from the suspension of pain, and the diminished strength of the pulsation, for a month after the application of the temporary ligature, that a degree of impediment to the current of blood in the artery had been produced; circumstances, which once led him to entertain hopes, that the cure of the aneurism was gradually accomplishing. At length, however, the increase of the tumour, and the aggravation of pain, and inflammatory symptoms, dispelled such expectation, and it was thought necessary to tie the femoral artery a second time, and adopt the common mode.

There are one or two points, about this case, on which the author does not particularly dwell, though they require consideration, ere one can form a correct judgment of the accuracy of one of his positions, "that non-pulsation of the sac is a sign auspicious, or otherwise, simply as it stands connected with increase or diminution of bulk, and pain." (*Med. Chir. Trans. Vol. 9. p. 415.*) The first question is, how are we to account for the sudden accession, of pain, the absence of pulsation, the increase of the swelling, and the other changes which happened on the 10th of January? Judging from the particulars given, I should say, that at this period, the aneurismal sac gave way, and the disease changed from the circumscribed into the diffused form; an alteration which would account for the pulsation being entirely lost, the increase of pain, and the extension of the swell-

ing, &c. Now, although the circumstance of the sac giving way, or the increase of pain, swelling, &c. on the 10th of January, may be taken as an argument, that the application of the ligature for *twenty-seven hours* had failed in producing obstruction enough in the vessel to retard the progress of the disease, we ought to remember, that, at the time when these changes happened, a trial of pressure was making, to which one might impute the change of the aneurism from the circumscribed to the diffused form, with quite as much probability, as to the enlargement of the sac by blood sent into it through the imperfectly obliterated artery. However this may be, certain it is, that the second operation was done, when no pulsation existed in the swelling; and perhaps, therefore, the case would have been doubly interesting, had the artery not been tied a second time, until circumstances had unequivocally proved, that this cessation of pulsation, attended as it was with an inflammatory state of the tumour, would not ultimately have ended in the cure of the disease.

Here, however, I may be speaking rather in the spirit of an experimenter, whose curiosity has not been fully satisfied, than as a surgeon, who should always be governed by the paramount consideration of extricating his patient from danger; and, this will appear the more likely, when I add, that my mind has long been made up about the inexpediency of the temporary ligature, as an innovation in surgery. The last case induced Mr. Travers to relinquish the temporary ligature; and among other reflections, which incline him to give up the practice, he candidly states, "that the adhesive union is prevented by the enclosure of a foreign body in the wound, long before suppuration has commenced. Suppuration is as certain to take place, though the ligature be removed after a few hours, as if it were left to be cast off; and the granulating process is more languidly performed, after an interruption in its early stage, for the purpose of removing the obstacle to union, than where no such interruption has been given, and the obstacle has been removed by nature's own means. Hence, it follows, that the theory, which, in removing the ligature within a given time, proposed the double advantage of a quicker, as well as a surer process, fails in both points, when brought to the test of practice upon the human subject." (See *Med. Chir. Trans.* p. 416-17.)

We have seen, that, when a temporary ligature, which had been applied to the brachial artery *fifty hours*, was withdrawn by Mr. Travers, pulsation in the aneurismal tumour at the bend of the elbow did not return, and the disease was cured; but, that, in another instance, where the ligature had been allowed to remain on the femoral artery only *twenty-seven hours*, a feeble pulsation was renewed a few hours afterwards in a popliteal aneurism, and as the swelling became painful and more diffused, some

weeks after this experiment, though no pulsation could then be perceived, the femoral artery was tied a second time, and the ligature left to separate in the usual manner.

But, from a case more recently published, it would seem, that the employment of a temporary ligature for only *twenty-four hours* on the femoral artery, may obliterate the vessel, and accomplish the cure of a popliteal aneurism. The patient was a seafaring man, aged 32; and the operator, Mr. Roberts, of Carnarvon; Mr. Evans and Mr. Carrey, other surgeons of that town, being present at the application, and also at the removal of the ligature. No pulsation recurred in the tumour; the edges of the wound were brought together with adhesive plaster; and, in eleven days, the part was quite healed. (*Med. Chir. Trans.* Vol. eleven, p. 100.) This is the strongest case, I believe, which has been adduced in support of the use of the temporary ligature, whether we consider the little time, which it was applied, the permanent cessation of all pulsation, the quickness with which the wound healed, or the complete recovery of the use of the limb; for when the patient was met six months after the operation, "he could go to the mast-head with as great facility as at any period of his life." This fact proves also, that there is a degree of irregularity in the period, when the temporary ligature may be removed, without the pulsation in the tumour below the constricted part ever returning. Whether the variety is to be referred to temperament, the kind of ligature used, its greater tightness in one case, than another, or other circumstances, is not at present determined.

The greatest advocate, which this practice has gained, is Scarpa, whose sentiments, however, about the most advantageous form of ligatures, and mode of applying them in cases of aneurism, are very much at variance with what is inculcated by the best, and most experienced surgeons in this country. Instead of using a fine ligature, composed of a single piece of thread, twine, or silk, he employs a cord consisting of from four to six threads, according to the size of the artery, which is to be tied; and, instead of aiming expressly at the division of the internal coats of the vessel with his ligature, as the generality of English surgeons do, for reasons explained in another part of this work, (See *Hæmorrhage*), he prefers a largish ligature, and interposing between the artery and the knot a small cylinder of linen spread with ointment, with the view of preventing the inner coats of the vessel from being divided. His reasons for this practice may be explained in a few words: he admits, that whenever there is a concurrence of all the circumstances, capable of inducing in the tied artery, the proper degree of adhesive inflammation, above and below the place where a single circular ligature has been applied, this method is adequate to produce the speedy and steady closure of the arterial tube. But, says he, it sometimes happens, at least in man, that

the pressure made by the circular ligature produces the ulcerative process more quickly in the artery, than the adhesive inflammation. In fact, the circular ligature ulcerates the artery in general about the third day after the operation; and the adhesive inflammation does not always complete its course in this period of time. During this delay of the adhesive inflammation, the ulcerative process, occasioned by the pressure of the ligature, attacks more quickly even than surgeons generally suppose, the external cellular sheath of the artery, and penetrates into the cavity of the yet pervious vessel—and this of course with increased quickness, when the inner coats of the artery are already divided by the ligature. The dangers of non-adhesion and too rapid ulceration of the artery, Scarpa thinks are placed at the greatest distance by preserving undivided all the three coats of the vessel under the pressure of the ligature; and hence, his partiality to larger ligatures, than are now used by the best surgeons in England, and to the interposition of a cylinder of linen between the knot and the vessel, as recommended by Paré, Heister, and Platner. If, however, he has had reason to suspect, that a simple circular ligature has frequently failed in England, because other innovations have been occasionally substituted for it, and because *we should not have sought for a better, if we had already had the best*, how much more vulnerable is his own practice on a similar principle; since, generally speaking, it has not retained half so many approvers as they who still express their preference to other methods, and more especially to the use of a single ligature, uncomplicated with other extraneous substances. Is it probable, he asks, that the single circular ligature, which was formerly used with doubtful success by the greatest surgeons, should now have become, as is pretended, the most certain means of preventing secondary hemorrhage? "It is now wished (says he) to ascribe the failures of Mr. Hunter, and of many other operators, not to the circular ligature, but to the improper treatment of the wound in general, and in particular to the introduction into it of lint, and, more especially, to the irritation occasioned by the ligature of reserve." On the contrary, it is argued by Scarpa, that, though Mr. Hunter, after his first trials, simplified the local treatment, though all skillful surgeons merely covered the wound with a pledget of soft ointment, and most of them omitted the reserve-ligature, yet, notwithstanding these reforms, secondary hemorrhage after the use of a simple circular ligature was not rendered less frequent. (*On Aneurism*, p. 23, ed. 2.) With respect to the latter general assertion, its incorrectness may be learned by reference to the details of Mr. Hunter's own operations, and by going into the principal hospitals of this metropolis, where the use of a simple circular ligature for the cure of aneurisms very rarely fails, as far as secondary hemorrhage

is concerned. Why then did the operation more frequently fail here in former times? The answer is plain: the kind of ligature now employed in England, cannot be compared to what was used in Mr. Hunter's time, or even to what was here in fashion five and twenty years ago. And, besides the universal rejection of ligatures of reserve, practitioners now have a more thorough comprehension of what ought to be avoided in the operation, have a just fear of separating and disturbing the artery too much, know how to appreciate the advantage of closing the wound, and attach due importance to the choice of smaller or more eligible ligatures. (See *Hemorrhage and Ligature*.) When, therefore, Scarpa supposes, that in England the practice with the circular ligature in the treatment of aneurism, is materially the same now, as heretofore, and that secondary hemorrhage is as frequent, he has not availed himself of all the information on this subject, which he might have acquired from Mr. Wishart, the able translator of his writings on aneurism, or from an attentive perusal of Mr. Hodgson's valuable treatise.

In an equality of circumstances, conducive to the success of the Hunterian operation, Scarpa thinks, that the fact is not proved, as it is presumed to be, that the rupture of the internal and middle coats of the artery does excite the adhesive inflammation and union of the artery more effectually, than is done by the simple compression and close contact of its two opposite internal parietes in a sound and uninjured state. This remark is partly true, and partly incorrect, at the same time that it involves a question, which must be deferred till we come to the article *Hemorrhage*. The truth in the observation is, that an artery may generally be rendered impervious with tolerable certainty, by compressing its opposite parietes steadily and firmly together for a certain time, without dividing its inner coats: the inaccuracy of it depends upon the fact, that, surgeons have no instrument, nor contrivance (not excepting even the ligature of four or six threads, with the interposition of the cylinder of linen spread with ointment,) which can retain the opposed undivided surfaces of the inner coats of the vessel closely together in the manner commended by Scarpa; and for the due time; without the objection of denuding more of the artery, than need be done in the application of a small ligature, or without the serious inconvenience, and risk, necessarily attending the introduction of a larger quantity of extraneous matter into the wound, than is desirable, with the view of averting all chance of the ulceration of the artery reaching beyond prudent limits. And, when metallic instruments are used for the same purpose, objections not less real are incurred, as will be hereafter more particularly explained.

Scarpa considers his mode of ligature ought to be preferred, as combining the triple advantage of preserving entire all the

three coats of the artery ; of exciting quickly, and in a proper degree, the adhesive inflammation in them ; and of retarding, as much as possible, the ulcerative process of the arterial tube.

Partly impressed, however, with the truth of the tenets laid down by Dr. Jones (See *Hæmorrhage*.) Scarpa enjoins attention to the following rules. 1. *Not to insulate and detach the artery any further, than is necessary for allowing a ligature to be passed around it.* 2. *Not to let the cylinder of linen exceed a line in length, or a little more above and below the breadth of the tape, which is about a line for the large arteries of the extremities.* 3. *That the ligature be not too tight.* 4. *And that it be never applied immediately below the origin of a large lateral branch.* (See *Scarpa on Aneurism*, p. 44, Ed. 2.)

Some further consideration of Scarpa's mode of applying the ligature will be introduced in the article *Hæmorrhage*; and I now proceed to notice his sentiments concerning the advantage which may be derived from removing the ligature in cases of aneurism, as soon as the tube of the vessel has been obliterated by the adhesive inflammation. Now, from the facts recorded by Scarpa, it is inferred, that, with the kind of ligature and the cylinder of linen used in his practice, the closure of the artery by the adhesive inflammation and the two internal coagula is sufficiently far advanced *on the third, or fourth day after the operation*, to resist the impulse of the blood ; and hence (says he) there is no rational motive for waiting beyond this time for the spontaneous separation of the ligature, or for allowing it, by its further presence, to ulcerate, and even open the artery at the principal point of adhesion. He then comments on the advantages to the wound, derived from the removal of all extraneous matter from it on the third, or fourth day. With respect to the general period of such removal, however, he makes one exception, viz. the case of great and evident debility from sickly constitution, or very advanced age, as it is observed, that, in such patients, the reunion of a simple wound is frequently protracted to the sixth day. *In cases of this description, Scarpa recommends delaying the removal of the ligature to the completion of the fifth or sixth day*, but under the express condition, that the ligature has been applied with the interposition of a cylinder of linen ; as it is proved, that a common circular ligature causes ulceration of the artery before the third day, and it is not till the sixth day that the external coat of the vessel begins to ulcerate, when the other modification of the ligature is adopted. (p. 50.)

Scarpa supports the preceding advice by four cases, in which his kind of ligature was applied, and withdrawn at the end of the third, or fourth day, and the arterial tube obliterated. However, I do not think, that in England, these cases, when minutely and attentively considered, will be regarded as inducements to persevere in the use of temporary ligatures. In every instance,

the wound is described as suppurating, and sometimes *plentifully*. In one, the foot mortified, and amputation became necessary. In another, the very day after the disturbance of removing the ligature, the thigh was attacked with erysipelas, and, on the eighth day, the wound is represented as being *foul*, and the erysipelas not yet cured.

Independently of the uncertainty of the period, when the arterial tube is closed by the adhesive inflammation in various patients, it appears to me, that the disturbance of the vessel and wound, by the steps necessary for the loosening and removal of the ligature, will ever form an insuperable objection to the practice. Scarpa appears to have some apprehension of this kind himself ; for he remarks, "In the act of removing the ligature, there can be no doubt it is of great consequence, that the artery be not rudely handled, or stretched. And, indeed, if, on untying the running knot, the subjacent knot could be with the same facility untied, we could not wish for a better mode of performing this part of the operation. But, the knot, although a simple one, is not so readily untied, as the running knot, on account of the moisture, with which the threads forming the ligature are soaked, or because the ligature has been previously waxed." (P. 64, Ed. 2.) In fact, his apprehensions then lead him to suggest the scheme of placing, previously to making the knot, a thread longitudinally, on each side of the cylinder, and at the time of removing the ligature, the threads are to be drawn in opposite directions, in order to undo the knot, without displacing, or stretching the artery. Thus, instead of one small ligature, which is all that an English surgeon leaves in the wound, Scarpa recommends his ligature of four, or six threads, a roll of linen, and two other threads ; a quantity of extraneous substances, which cannot fail to be a source of irritation and serious mischief. I shall therefore take leave of the proposal of removing the ligature on the third, or fourth day, or any other particular day, with expressing my belief, that, if there were only the following objection to the plan, it would never be adopted in this country ; namely, the advocates for this practice are necessarily obliged to renounce the infinite advantage of bringing the edges of the wound together directly after the operation. Had the suggestion of Dr. Jones proved invariably correct, and the ligature admitted of being withdrawn immediately after the inner coats of the vessel had been divided by it, the case would have been very different, as there would then have been no foreign body at all left in the wound ; the parts might have been immediately brought together with the greatest chance of union by the first intention, and no subsequent disturbance either of the artery, or of the wound, would have been incurred.

The next practice, which I shall notice, is that of applying two ligatures to the artery, and cutting it through in the interspace. This suggestion may be said to be as ancient as

the time of Celsus, who has advised this method to be followed in the treatment of a wounded artery: "*Quæ (arteriæ) sanguinem fundunt apprehendendæ, circque id quod ictum est duobus locis deligendæ intercedendæque sunt, ut in se ipse coeant, et nihil homini ora reclusa habeant.*" (*De Medicina, Lib. 5, c. 26, § 21.*) The fact is curious, though I mention it without the least intention of detracting from the great merits of several modern surgeons, that the Greeks were acquainted with the practice, lately recommended, of tying and dividing the trunk of the artery high above the tumour, as will appear from the following extract: (*Ætlii. 4. Serm. Tetr. 4. cap. 10.*) *At vero quod in cubiti cavitate fit aneurisma, hoc modo per chirurgiam aggredimur: primum arteria superne ab ala ad cubitum per internam brachii parte simplicem sectionem, tribus, aut quatuor digitis infra alam, per longitudinem facimus, ubi maxime at lantum arteria occurrit: atque ea paulatim devudata, deinceps incumbentia corpuscula sensim excoriamus ac separamus, et ipsam arteriam cæco uncino attractam duobus filiis vinculis probe adstringimus, mediamque inter duo vincula dissecamus; et sectionem polline thuris explemus, ac linamentis inditis congruas deligationes adhibemus.* Afterwards we are directed to open the aneurismal tumour at the bend of the elbow, and when the blood has been evacuated, to tie the artery twice, and divide it again. - If the ancients had only omitted the latter part of their operation, they would absolutely have left nothing to be discovered by the moderns.

This method of applying two ligatures to the artery, and dividing the vessel between them, was revived in France about half a century ago by Tenon, who, as well as some later surgeons, was totally unacquainted with its antiquity. (See *Pellelian's Clinique Chirurgicale, T. 1. p. 192.*) At one time, it had also modern advocates in Mr. Abernethy and Professor Maunoir, of Geneva, each of whom supposed the plan an invention of his own. (See *Surgical and Physiol. Essays, Part 3, 8vo. Lond. 1797, and Mémoires Physiologiques et Pratiques sur l'Aneurisme &c. 8vo. Geneve, 1802.*)

When an artery is laid bare, and detached from its natural connexions, and the middle of such detached portion tied with a single ligature, as was Mr. Hunter's practice, Mr. Abernethy conceived, that the vessel, so circumstanced, would necessarily inflame, and be very likely to ulcerate. The occurrence of bleeding from this cause at first led to a practice, which this gentleman justly censures, viz. applying a second ligature above the first, and leaving it loose, but ready to be tightened, in case of hemorrhage. As the second ligature, however, must keep a certain portion of the artery separated from the surrounding parts, and must, as an extraneous substance, irritate the inflamed vessel, it must make its ulceration still more apt to follow. The great object, therefore, which Mr. Abernethy insisted upon, was that of applying the ligature close to that part of the artery, which lies among its natural con-

nexions; a just principle, the truth and utility of which still remain incontrovertible, though there may be a better way of accomplishing what Mr. Abernethy intended, than the measures which this gentleman was led to recommend.

The peculiarity in Mr. Abernethy's first operation consisted in applying two ligatures round the artery, close to where it was surrounded with its natural connexions. For this purpose, he passed two common sized ligatures beneath the femoral vessels, and having shifted one upwards, the other downwards, as far as these vessels were detached, he tied both the ligatures firmly.

The event of this case was successful. An uneasy sensation of tightness, however, extending from the wound down to the knee, and continuing for many days after the operation, made Mr. Abernethy determine, in any future case, to divide the artery between the two ligatures, so as to leave it quite lax.

Mr. Abernethy next relates a case of popliteal aneurism, for which Sir Charles Blinck operated, and divided the artery between the ligatures. The man did not experience the above kind of uneasiness; and no hemorrhage ensued when the ligatures came away, although there was reason to think, that the whole arterial system had a tendency to aneurism, as there was also another tumour of this kind in the opposite thigh.

The reasoning, which induced this gentleman to revive this ancient practice, was ingenious; for, when the artery was tied with two ligatures, and divided, in the foregoing manner, it was argued, that it would be quite lax, possess its natural attachments, and be as nearly as possible in the same circumstances as a tied artery upon the face of a stump. Strictly speaking, however, as Mr. Hodgson first pointed out, an artery tied in two places, and divided in the interspace, cannot be regarded as placed exactly in the same condition, as an artery tied in amputation. In the latter case, the retraction of the vessel corresponds with that of the surrounding parts, which are divided at the same instant, and therefore its relative connexions stand as before the operation. But, in the operation for aneurism, the retraction of the artery takes place, without being attended with a corresponding retraction of its connexions. How far the retraction of the artery is beneficial, or injurious, is by no means evident; and the advantages arising from it may in most situations be obtained, without dividing the vessel, by placing the limb in a bent position. One important object, however, is gained by the division of the artery; namely, that it is generally in that case tied close to its connexions; and it is very evident how liable the application of the ligature in the middle of a denuded extent of the vessel must be to produce ulceration or sloughing of its coats. The same object, however, will be gained by tying the undivided artery close to its connexions at the end nearest to the heart; and the existence of a single ligature at the bottom of the wound will be less liable to give rise to supuration and the formation of sinuses, than

the employment of two. When an artery is divided, the portions situated beyond the ligatures must slough, and prove an additional cause of suppurative in the wound. Experience has amply proved the safety of employing a single ligature, and it is at present used by many of the most experienced operators in this country. (See Hodgson's *Treatise on the Diseases of Arteries*, &c. p. 221, &c.)

According to Scarpa, numerous examples of the failure of the plan of applying two ligatures, and cutting through the artery in the interspace, are already generally known to the profession, and there are many expert and ingenious surgeons, who do not dissemble the disadvantage and uncertainty of this practice. He speaks of one failure, which occurred to Mr. Abernethy himself. But, I entertain doubts how far any inference against the method can be drawn from Monteggia's instance, in which a ligature of reserve had been used. Nor can I understand, how a circumstance, which Scarpa strongly insists upon, can be well founded, I mean, the danger of the ligature being forced off the mouth of the artery by the impulse of the blood. Any risk of this kind cannot exist if the ligature be duly applied, as Dr. Jones has particularly explained; and, at all events, how can it be greater here, than after amputation, where it is not usually made a subject of complaint? Indeed, the several examples of secondary hemorrhage, after this method, quoted by Scarpa from the practice of Monteggia, Morigi, and Assalini, may be more rationally imputed either to reserve ligatures having been also used, or the common fear in Italy of applying the ligatures tightly; in which event, one can readily suppose, that the ligature might really slip, or by remaining a long time on the vessel might give rise to dangerous ulceration. Thus, Morigi speaks of one case, in which the bleeding occurred on the nineteenth day. (Scarpa on *Aneurism*, p. 14, Ed. 2.) On the whole, I am disposed to believe, that when this method has been executed precisely according to Mr. Abernethy's directions, it has not often failed; and I am acquainted with only one case in London, in which it was followed by secondary hemorrhage. However, in the year 1807, Mr. Norman, of Bath, tied the femoral artery with two ligatures, and divided the vessel between them; the upper ligature came away on the sixteenth day after the operation; the lower one on the fifteenth; and the following day a profuse hemorrhage came on, the patient losing a pound of blood. Pressure with a compress and wet bandage was continued for some time, and the wound healed. (See *Med. Chir. Trans.* Vol 10, p. 123.) This is the only case of secondary hemorrhage, which he has met with after operating for aneurisms.

Scarpa very properly urges, that the application of two ligatures, and dividing the artery in the interspace, can never be an eligible mode, where the smallness of the space, the depth of the artery, and the im-

portance of the surrounding parts, do not permit the vessel to be separated and insulated to such an extent, as is required for dividing it, with a probability of the division of it being sufficiently distant from the two ligatures. Such, for example, are the cases of ligature of the carotid in the vicinity of the sternum; of the iliac, above Poupart's ligament; of the internal iliac, a little below its origin from the common iliac; of the axillary artery between the point of the coracoid process and the acromial portion of the clavicle: or of the subclavian in its passage between the scaleni muscles. Scarpa then comments on the difficulty and even impossibility of taking up the end of the truncated artery again in many situations, were hemorrhage to ensue; and he joins Mr. Hodgson in thinking the advantages of the method, even where it is practicable, by no means demonstrated. Nay, he goes further; for he agrees with Heister, Callisen, and Richter in setting it down as worse than useless, on account of the portion of the artery between the ligatures being converted into a dead and putrid substance, which rests upon the bottom of the wound, from which it cannot be removed, until the two ligatures are separated. Here, deeply impressed with the truth of principles, which perhaps he has rather lost sight of in speaking of his own particular method, he comments on the little probability of the wound uniting, under the disadvantage of two ligatures hanging out of it, and of sloughs at its bottom. He argues correctly, that the laying bare, and insulating a large portion of artery, would often be objectionable on the ground, that it could not be done, without the surgeon being obliged to apply the principal ligature too near the origin of a large lateral branch; as, for example, would be the case in a case of inguinal aneurism, situated *an inch and a quarter* below the origin of the profunda. Thus, a coagulum could not be formed, and the artery would be in danger of not being closed. On the contrary, by employing only a single ligature at *an inch and a quarter* below the origin of the profunda, the operation would be equally simple and successful. (Scarpa on *Aneurism*, p. 19—21, Ed. 2.)

The frequent occurrence of accidents after the introduction of Mr. Hunter's operation, however, might have been ascribed to more probable causes, than the condition of an undivided artery, upon which the ligature was applied. The employment of numerous ligatures gradually tightened, or the introduction of extraneous bodies into the wound, were alone sufficient to produce ulceration of the artery: and such practices were adopted in most of the cases, in which secondary hemorrhage took place.

After the reasons, which have been urged against the plan of tying the artery with two ligatures, and dividing it in the interspace, it may appear superfluous to notice a modification of this practice, intended as a sec-

ity against the slipping of the ligature. But, as the proposal has had the approbation of some men of eminence, and I heard of an instance in which it was practised not long ago, the subject may still be worthy of notice.

Mr. A. Cooper has published a case of popliteal aneurism, in which the femoral artery had been tied with two ligatures, as firmly as could be done without risk of cutting it through. "But (says this gentleman) as I was proceeding to dress the wound, I saw a stream of blood issuing from the artery, and when the blood was sponged away, one of the ligatures was found detached from the vessel. Soon after the other was also forced off, and thus the divided femoral artery was left without a ligature, and unless immediate assistance had been afforded him, the patient must have perished under hemorrhage."

The same kind of accident has occurred in Mr. Cline's practice.

These events naturally induced Mr. A. Cooper to reflect on the means, which were to be employed to obviate them, and the first which suggested itself was to include a larger portion of the artery between the two ligatures. But this plan was given up when it was recollected, that many branches of arteries must be divided, and that it was a mode of security which could only apply to particular cases of aneurism, since in some situations of that disease, there is scarcely any length of vessel between the tumour and principal anastomosing branch of the artery.

Mr. A. Cooper thinks, that a plan of greater security, and more general application, consists in conveying the ligatures, by means of two blunt needles, under the artery, an inch asunder, and close to the coats of the vessel, excluding the vein and nerve, but passing the threads through the cellular membrane surrounding the artery. When these are tied, and the artery is divided between them, the ligatures will be prevented from slipping from the artery by the cellular membrane through which they are passed. Mr. A. Cooper next relates a case of aneurism after bleeding, which he cured by this way of operating.

"But although this plan, as to the event, answered my expectations, yet a different mode of securing the ligature, suggested to me by my young friend Mr. H. Cline, struck me so forcibly for its simplicity and security, that I felt immediately disposed to adopt it.

Mr. A. Cooper put the new plan to the test of experiment in operating for a popliteal aneurism on Henry Figg, aged 29. "An incision being made on the middle of the inner part of the thigh, and the femoral artery exposed, the artery was separated from the vein and nerve, and all the surrounding parts, to the extent of an inch, an eye-probe, armed with a double ligature, having a curved needle at each end, was conveyed under the artery, and the probe cut away. The ligature nearest the groin

was first tied; the other was separated an inch from the first and also tied. Then the needles were passed through the coats of the artery, close to the ligatures between them, and the ends of each thread were again tied over the knots, made in fastening the first circular application of the ligatures. Thus, a barrier was formed, beyond which the ligature could not pass." The event of this operation was successful. (*Med. and Phys. Journ. Vol. 8.*)

Upon the foregoing proposal a few observations are necessary; and these I shall offer with due deference to the eminent surgeon, whose fame alone has attached undue importance to the innovation.

It appears to have been mentioned by Dionis, and to have been noticed by some subsequent writers. In the 13th chapter, on hemorrhage, in Richter's *Anfangsgrunde der Wundarzneykunst*, we read the following passage.

"The artery, when drawn out, is to be twice surrounded with the common ligature. This is to be tied in a knot, and when the artery is large, one end of the ligature is to be passed, by means of a needle, through the vessel before the knot, then both ends are to be tied together, and left hanging out of the wound, as in the ordinary way." Ed. 3. 1799.

What power can possibly force the ligature, when tied with due tightness, off the extremity of the vessel? No action of the heart, or artery itself, no turgid state of this vessel, could do so. If a piece of string were tied round any tube for the purpose of preventing a fluid from escaping from its mouth, provided the string were applied with due tightness, and the knot in such a manner as not to yield, no fluid could possibly escape, however great the propelling power might be, provided the string and structure of the tube did not break. And, if a ligature were applied so slackly as to slip, who can doubt, that hemorrhage would still follow, even though the ligature were carried through the end of the vessel, and tied in the foregoing way?

Where ligatures have slipped off, very soon after being applied, I conclude, that the arteries either could not have been tied with sufficient tightness, perhaps through an unfounded fear of the ligature cutting its way completely through all the coats of an artery, or else that the knot, or noose became slack, from causes, which will be understood by considering, what is said on this matter in the article *Hemorrhage*. The inner coats of the artery, we know, from the experiments of Dr. Jones, ought to be cut through when the artery is properly tied, because the circumstance is always useful in promoting the effusion of lymph, within the vessel, and the process of obliteration by the adhesive inflammation.

The preceding method is so contrary to the grand principle of always avoiding the detachment of the artery from its surrounding connexions, and is so inconsistent with

the wise maxim of doing the operation with as little disturbance of the vessel as possible, that it is not surprising that it should have met with only a small number of followers. In fact, it is not only liable to every objection which can be urged against the double ligature and division of the artery, as formerly proposed by Celsus, and a few of the moderns, but, on account of its greater tediousness, more extensive separation and destruction of the vessel, and other reasons, is still less worthy of imitation.

With respect to ligatures of reserve, the interposition of agaric, cork, and other hard substances between the knot and the artery, these contrivances are now so fully rejected by all good surgeons, for reasons which will be quite intelligible, after the perusal of another part of this work, (See *Hemorrhage*,) that I shall not at present detain the reader with animadversions on their danger. As for several kinds of metallic compressors, intended to be applied to the exposed artery, for the purpose of rendering it impervious, they are inventions which have been made and extolled by some surgeons of high repute, whose names would give importance even to a less meritorious proposition.

Dubois conceived, that hemorrhage might sometimes proceed from the circumstance of a ligature making its way too fast through the artery. He thought, also, that the sudden stoppage of the current of blood by a tight ligature might bring on gangrene of the limb, particularly, where the aneurism was not of long standing, so that the collateral branches had not had time to enlarge. Dubois, therefore, proposed a method of gradually stopping the flow of blood through the artery; and, by this ingenious imitation of the process of nature, to promote the gradual dilatation of the collateral arteries, and obviate all risk of gangrene in the lower part of the limb. This gentleman put his plan in execution, and two instances of success are recorded. The cases were popliteal aneurisms. A ligature was passed under the artery in the manner of Hunter; its two ends were then put through an instrument, called a *serre-neud*, with which the compression was gradually increased. It is stated, that, in one of these cases, the plan made the artery inflame and become impervious, in the course of the first night, so that on the following day the throbbing of the tumour had ceased. (*Richerand, Nosogr. Chir. T. 4, p. 109, Edit. 4.*) Here, however, it is to be suspected, that the pressure of the apparatus was greater, than was calculated; and that the stoppage of the pulsation was more owing either to this cause, or to the coagulation of the blood, in the sac and adjoining portion of the artery, than to the process of obliteration, which could hardly have been so rapidly accomplished.

Assalini's compressor is an instrument, calculated, as its inventor states, to produce an obliteration of the trunks of arteries,

without dividing, or injuring their coats. It is nothing more, than a small pair of silver forceps, the blades of which are broad and flat at their extremities, between which the artery is compressed. A spring, composed of a piece of elastic steel, is attached to the inside of one of the handles, and by pressing against the opposite handle, retains the flat ends of the blades in contact. This spring is intended to be very weak in its operation; but, by means of a screw, which passes through the handles, the pressure admits of being regulated and increased at the option of the surgeon.

A representation of Assalini's compressor may be seen in his *Manuale di Chirurgia, parte Prima, p. 113*. In the same book, or, in my friend Mr. Hodgson's valuable *Treatise on the Diseases of Arteries and Veins*, which every practical surgeon ought to possess, a case may be perused, in which this instrument was successfully employed by Professor Monteggia, and withdrawn entirely, as early as sixty hours after its application. This last distinguished surgeon also used the compressor in an example, in which the femoral artery was wounded, and bled in an alarming degree. After forty hours, the pressure was lessened, and, in four hours more, as not a drop of blood issued from the vessel, and there seemed to be no good in leaving an extraneous body in the wound any longer, the instrument was taken out altogether. (See *Assalini's Manuale di Chirurgia, p. 110.*)

When Assalini was in England, he acquainted Mr. Hodgson, that, in two cases of popliteal aneurism, in which he had himself employed this means of obliterating the femoral artery, the instrument was removed at the expiration of twenty-four hours; no pulsation returned in the tumours; and the patients were speedily cured.

With respect to the particular merit of this invention, it certainly possesses the recommendation of ingenuity; but, it operates much in the same manner, as several other mechanical contrivances, the *serre-neud* of Desault, the *presse-artere* of Deschamps, that of Mr. Crampton, (See *Med. Chir. Trans. Vol. 7.*) the pincers of Baron Percy, &c. If there be a real advantage in the division of the internal coats of an artery by the ligature, as the experiments of Jones seem to prove, and as many of the best surgeons in this country inculcate, (See *Hemorrhage and Ligature*,) then the compressor cannot be an eligible means of obliterating an artery. It may be said, however, that experience has proved its efficacy; but, let it be recollected, that almost every method of operating for aneurisms has sometimes answered. Further experience is requisite to determine, whether Assalini's compressor would succeed as often as, or more frequently than, the scientific application of the right kind of ligatures (See *Ligature*) which may perhaps seem slower in their effect, only because they are not in general removed as early as Assalini's instrument. In fact, the experi-

ments of Mr. Travers have now proved, that the ligature is the quickest in its operation. (See *Med. Chir. Trans. Vol. 6, p. 643, &c.*)

In 1816, some ingenious observations were published by Mr. Crampton, on the effects of the ligature and of compression in obliterating arteries. The purport of his remarks is to prove, like the later observations of Scarpa; 1st, That the obliteration of an artery can *very certainly* be effected, independently of the rupture, or division of any of its coats; 2dly, That this operation of the ligature, so far from being essential to the process, not unfrequently defeats it. (See *Med. Chir. Trans. Vol. 7, p. 344, 345.*)

With respect to the first of these assertions, I presume that all practical surgeons have known and admitted it, especially, if the words *very certainly* be left out. Every system of surgery, for half a century past, has recorded the occasional cure of aneurism by different modes of compression, by which the adhesive inflammation is excited in the artery, or the coagulation of the blood in the aneurismal sac brought about. As, however, the most experienced surgeons have found the method less certain than the use of the ligature, it is not represented by any modern writers, as deserving equal confidence; though there are circumstances, in which simple pressure may be sometimes tried, with a hope of doing away all occasion for an operation. The cases, however, in which compression is applied directly to the artery itself by means of ligatures, with the intervention of other substances, as advised by Scarpa, &c. or by various contrivances, like those of the *serre-nœud*, the *presse-artère*, and Assalini's forceps, all require the exposure of the artery; and if commendable, therefore, cannot be so on the principle of saving the patient the pain of an operation, but because they are more effectual than the employment of the ligature. This last point remains to be proved. From the comparatively small number of instances, in which the preceding modes of compression have been practised, I could quote several examples of failure, were it necessary.

With regard to Mr. Crampton's second assertion, that the division of the inner coats of the vessel, so far from being essential to the process of obliteration, not unfrequently defeats it, I think the last part of the observation is altogether unproved. We must admit, that the division of the inner coats is not essential, because arteries sometimes become obliterated under a variety of circumstances, in which such division is not made; but still, the great question remains, whether it renders the process more certain. Mr. Crampton founds his conclusion, that it not unfrequently prevents the obliteration, and gives rise to secondary hemorrhage, upon a few very uncommon cases, in which aneurismal swellings have taken place above the ligature. (See *Warner's Case, p. 123 of this Dictionary.*) Here Mr. Crampton presumes, without proof, that the oc-

currence happened from the division of the inner coats of the artery, though Mr. Warner himself suspected, with more probability, that it proceeded from a diseased state of the vessel. Besides, this event, be it produced in whatever manner it may, is so rare, that I only know of three examples of it on record, and have never known it occur during the last 23 years, that I have been in the constant habit of seeing numerous operations performed. In Mr. Warner's time, such large ligatures were also in use, that it appears to me, they were more likely merely to press the sides of the artery together, like Mr. Crampton's *presse-artère*, than effect a complete division of the inner coats of the vessel, as is accomplished by the small ligatures in modern use.

Those metallic instruments, intended to be applied directly to an exposed artery, for the purpose of obliterating it by compression, are liable, as Scarpa remarks, to all the inconveniences, which are inseparable from the presence of hard bodies, introduced, and kept for several days in the bottom of a wound; especially when this is recent, in which case, they cannot be retained in a proper direction without difficulty, or exactly at such a depth, as will not be attended with hurtful pressure upon the wound itself, and important parts in its vicinity. And, with regard to the forceps of Assalini, Monteggia has observed, "*if the obliteration of the artery is retarded, the forceps equally divides the artery by causing the death of the included portion. I also saw, in one case, the extremity of the instrument resting at the bottom of the wound on the subjacent femoral vein, rupture its anterior half also, although we were sure it had not been included by it.*" (*Instituz. di Chir. Ed. 2, T. 2.*) And although Cumano, in a case of popliteal aneurism, obtained on the fourth day, the closure of the femoral artery, by means of Assalini's forceps, he does not conceal that the cure of the wound was rather difficult; and in comparing the ligature with the forceps, he adds his belief, that if an equal result is derived from both, the preference will be given to the ligature, unless the other instrument be brought to such perfection that the inconveniences will be removed, from which he found it not exempt, though the operation succeeded. (*Annali di Med. del Dottore Omodei, Settembre 1807, p. 309, and Scarpa on Aneurism, p. 45, Ed. 2.*) Some experiments were a few years ago instituted by Mr. Travers, in order to determine the merit of Assalini's forceps, compared with the ligature: and his conclusion from the facts elucidated in the investigation is, that the ligature is a more powerful means for affecting the obliteration of the tube of an artery. (See *Med. Chir. Trans. Vol. 6, p. 643, &c.*)

My friend, Mr. Lawrence, a few years ago, extended to operations for aneurism the method of tying the artery with a very small firm silk ligature, the whole of which is immediately afterwards cut off, with the exception of the noose and knot, and an endeavour then made to heal the wound

by the first intention. In a case of popliteal aneurism, Mr. Carwardine, late of Thaxted, tied the femoral artery in this manner, and the wound united entirely by the first intention, not a particle of pus having been formed at any time; and the part continued perfectly sound at the distance of some months from the operation. On the 29th of March, 1817, I saw Mr. Lawrence try the practice in a similar case: with the exception of the integuments, the wound united by adhesion. However it continued to discharge a small quantity of matter till the end of May, when the ligature came away, and it healed firmly. In an aneurism of the humeral artery, Mr. R. Watson, of Stourport, Worcestershire, tied that vessel and cut off the ends of the ligature, as proposed by Mr. Lawrence. The operation was done on the 2d of March, and the wound was quite healed by the 10th of April. On the 3d of May, a small tubercle which had been felt under the skin, in the centre of the cicatrix, appeared above the skin, and proved to be the knot of the ligature. There was no inflammation or discharge; but, the ring of the ligature was firmly impacted in the centre of the cicatrix. In about a week from this time, the whole of it was expelled. In another case, where Mr. Hodgson tied the ulnar artery, and cut off the ends of the small ligature, the skin healed over the vessel, but a firm almost cartilaginous knot gradually formed, from the centre of which the bit of ligature was extracted five or six months afterwards by a small puncture. For additional observations on this part of the subject, See *Med. Chir. Trans.* Vol. 8, p. 490, &c.

Mr. Carwardine's case is a strong one in favour of this method: but, I am not aware, that sufficiently numerous trials of it have been made to enable one to form a correct estimate of its merits. With the exception of the example communicated by Mr. Carwardine to Mr. Lawrence, I apprehend, that, on the whole, the cures on record cannot be said to have been completed sooner, than generally occurs in other instances, in which one end of the small circular ligature is left for the removal of the noose. Thus, in two cases, where the practice was tried by Mr. Norman, of Bath, the results were by no means encouraging. In one of these instances, a part of the wound appeared to have united by the first intention, but matter afterwards formed, and it was a considerable time before the ulcer healed. The ligature was never seen to come away; but from the circumstance of the suppuration, Mr. Norman apprehends, that it must have been voided. In a second example, the attempt to procure a permanent adhesion of the parts over the ligature did not succeed; a long and troublesome suppuration ensued, and the wound was not healed till the latter end of April, though the operation was done on the 7th of March, (*Norman, in Med. Chir. Trans.* Vol. 10, p. 120—121.) As catgut, however, was employed for the ligatures in these two operations, I do not know, that it is fair to consider the method exactly as

that recommended by my friend Mr. Lawrence, who particularly directs very small ligatures of dentist's silk to be used. But, besides the different material employed, we are left uninformed of the thickness of the catgut; and, in this respect also there would probably be no greater similarity between the ligatures of these gentlemen, than there is in regard to the substances, of which such ligatures were made. In favour of catgut, as a ligature, when the ends of it are to be cut off, a case published by Mr. A. Cooper deserves particular notice. The wound was found completely united on the fourth day after the operation, notwithstanding the patient was eighty years of age. The catgut, previously to its application, was softened in warm water. The recovery was complete; a fact, strongly proving the propriety of not rejecting an operation on account of age, if no other objections exist. (See *Surgical Essays*, part 1, p. 126.)

Alluding, however, to silk ligatures, if we take into the account the little ulcerations, suppurations, and hard knots, which occurred even after their use in this manner, I fear, that, though these complaints might be attended with no severe inconvenience, they will deter many surgeons from adopting the innovation; unless it can be proved that these inconveniences, slight as they were, were counterbalanced by the quicker healing of the incision, or some other decided benefit. As a mode, attended with the least possible risk of being followed by secondary hemorrhage, however, I consider it inferior to no practice, which has yet been suggested; nor do I know of any serious objections to it in any point of view, provided exactly such ligatures are used as Mr. Lawrence recommends.

In cases of aneurism, a single small ligature, composed of dentist's silk, inkle, or twine, is now usually preferred by the majority of the best surgeons in England; but, as the right qualities of ligatures are elsewhere considered, (See *Hemorrhage and Ligature*) I need not here dwell upon the subject. It is not meant to assert, that the use of a single ligature is never followed by secondary hemorrhage; for this would be untrue. The accident I believe will sometimes happen after this, or any other mode, under certain circumstances, and in unfavourable subjects. A fact of this kind we find recorded, which happened in the practice of a truly eminent and experienced surgeon; (See *A. Burns on Diseases of the Heart*, p. 230;) but, from the inquiries, which I have made, it appears to me proved, that, *ceteris paribus*, a single small ligature, applied with as little disturbance and detachment of the artery as possible, will be more rarely followed by secondary hemorrhage, abscesses, sinuses, &c. than any other known method. Thus, in the several cases, reported by Mr. Norman, the single ligature was never followed by any of those inconveniences, which, he justly thinks, will be rarer after this practice, than any other, "if the artery be not removed from its situation, or more detached, than the liga-

ture separates it." (See *Med. Chir. Trans.* Vol. 10, p. 123.)

Before entering into the consideration of particular aneurisms, I wish to mention a few other circumstances, worthy the attention of every practical surgeon. The first is the partial entrance of blood into the aneurismal sac, after the artery has been tied at some distance from the tumour. This fact was first particularly pointed out, and its reasons explained by Sir E. Home, who published three examples of its occurrence. (See *Tran. of a Soc. for the improvement of Med. and Chir. Knowledge*, vol. 1, p. 173, & vol. 2, p. 239.) But, the circumstance had never, I believe, been considered with due attention, until Mr. Hodgson made it one of the subjects of his reflections in his valuable treatise.

"When an artery is tied close to an aneurismal sac, the ingress of blood into the latter is in most instances prevented; the coagulum, which it contains, is absorbed, and the membranes of which the sac is composed, gradually contract, until its cavity is permanently obliterated. But, when the artery is tied at a distance from the disease, the ingress of blood into the latter is not altogether prevented; for, the anastomosing branches, which open into the trunk, below the seat of the ligature, convey a stream, which passes through the aneurism. The impulse of this current, however, is so trifling, that the enlargement of the sac not only ceases, but the deposition of coagulum in it increases, in consequence of the languid state of the circulation. The coagulum accumulates, until the cavity, of the sac, and the mouth of the artery leading into it, are obliterated," &c. (See *Hodgson on the Diseases of Arteries*, p. 266.)

This fact, which is of great importance, both in a practical and pathological point of view, is proved, (says this gentleman,) 1st, by the occasional recurrence of pulsation in the tumour after the operation; 2dly, by cases in which the cavity of the sac has been exposed, and hemorrhage has been the consequence; and 3dly, by dissection, in which it has been found, that the cavity of the aneurism, as well as that of the artery, from which it originated, was pervious, from the part which was obliterated by the direct operation of the ligature.

For a detail of the facts relative to this interesting point, the reader is referred to Mr. Hodgson's valuable publication. (*P. 267, et seq.*)

Some very uncommon instances are recorded, in which the return or continuance of pulsation in the tumour is said to have prevented the cure; the aneurismal sac having begun to enlarge again. The two cases of this kind, however, which happened in the practice of Pott and Guérin, (*Tran. of a Soc. for the Imp. of Med. Chir. Know.* vol. 1, p. 172, & *Journ. de la Soc. de Santé*, No. 3, p. 197.) cannot be well depended upon, as it may be doubted, whether the artery had really been tied. Some better established facts, relating to this part of

the subject, have been very recently published. One is a case by Dr. Monteath, jun. of Glasgow, which is very remarkable; as the disease, viz. a popliteal aneurism, recurred nine months after the femoral artery had been unequivocally tied in the upper third of the thigh. On the 27th of February, 1819, this gentleman performed the operation, using a single ligature, the pulsation of the tumour in the ham instantly ceased; and the wound healed by the first intention, except where the ligature was situated, which came away on the thirtieth day. By this time, the tumour was diminished to one half of its original size, and, in two months more, only a hard knot was perceptible, in which no pulsation whatever could be felt. After the considerable lapse of time, above specified, the patient informed Dr. Monteath, that the tumour had reappeared, being rather larger than a plum. The pulsation in it was distinct, though not so strong as an ordinary aneurism. As the size of the swelling, and strength of the pulsation, increased gradually, a compress and bandage were applied, without confinement; but, as this treatment was ineffectual, the patient was afterwards kept in bed, bled, and put on a spare diet. A thick compress was placed over the tumour, and, the limb was firmly bandaged from the toes to the groin. A trial of this plan for three days not having produced any benefit, a tight tourniquet was applied over the tumour; but the pain was such in half an hour, that the instrument was taken off, from which moment no pulsation was felt. Next day the tumour not only did not throb, but had a firm feel; and, the bandage being continued, the cure was gradually completed. Had the disease not yielded to these means, Dr. Monteath meant to have tied the inguinal, or external iliac artery, with the view of cutting off the supply of blood to the sac, through the anastomosing branches. (*Scarpa on Aneurism by Wishart*, p. 510—512, Ed. 2.)

The external iliac artery was taken up by Mr. Norman, of Bath, for the cure of an inguinal aneurism, and when the collateral circulation was fully established a few days after the operation, the tumour was again supplied with blood in sufficient quantity to produce a distinct pulsation; "a fact," (says Mr. Norman) of practical importance, as it shows, that though the ligature on the iliac artery stops the direct influx of blood into the tumour, and is the means, by which the disease is cured, yet that there exists a necessity for employing strict rest, the antiphlogistic regimen, and in some cases, the abstraction of blood, to assist nature in her operation of obliterating the aneurism." And, in another instance, after the same gentleman had tied the femoral artery for the cure of popliteal aneurism, the pulsation, though stopped for a time in the tumour, afterwards recurred in such a degree, that much doubt was entertained whether the disease would have been cured by the ligature, on the femoral artery, had

not continued and rather powerful pressure been adopted (*Med. Chir. Tran. Vol. 10, p. 99, 118, &c.*)

M. Roux, in a late work, has offered some criticisms on the English method of operating for aneurisms. It would hardly be fair play to endeavour to offer a serious refutation of them, because when he wrote, it was his misfortune not to be duly informed of all the facts and experiments recorded in the inestimable treatise on hemorrhage by the late Dr. Jones. "Still less confident, than we are (says Roux,) in the treatment by compression, and in the use of topical remedies for the cure of external aneurisms, the English surgeons have immediate recourse to the operation with the ligature. Hunter's method is that which they universally practise. They will not even allow, that there are any cases, in which the operation by opening the sac should be preferred, &c. And it is singular, the very same motive, which would incline us in some cases of aneurisms, properly so called, to adopt the operation of opening the sac, is alleged by the English surgeons as a circumstance in favour of the Hunterian method. Let us suppose an aneurism so formed, that near the centre of the tumour, or rather near the opening, by which the artery communicates with the swelling, are situated the orifices of the collateral arteries, which would be useful for the re-establishment of the circulation. Here, it is clear, that in practising the operation by the Hunterian method, that is to say, in tying the artery above the tumour, the last ramifications are not indeed sacrificed; but the orifices and first branches of these collateral arteries. Let there be, for example, at the upper part of the femoral artery an aneurism, which, though formed originally below the origin of the profunda, now extends above it. Here it is manifest that, in tying the femoral artery above the swelling, we should lose the important resource of the profunda for re-establishing the circulation in the lower part of the limb. The desire and hope of saving the profunda would, in such a case, make us adopt the operation of opening the sac, in preference to the Hunterian method; and Scarpa himself, so great an advocate for this last mode, Scarpa, who seems only to have composed his work to cry up this method, makes an exception of the case, which I have just been supposing. The English surgeons, on the contrary, would urge the following objection to the operation by opening the sac in this, and other analogous examples. They contend, that the ligatures would be applied too near to the origin of the collateral arteries, which are to receive the blood after the operation. They are prepossessed with the idea, that, when an arterial trunk is tied at a given point, the too great proximity of the principal collateral arteries disposes to subsequent hemorrhage; &c." (p. 256, 257.) a circumstance, which M. Roux, seems to doubt.

Now, before attempting to reply to these

observations, we ought to know what exact distance Roux means, when he speaks of the profunda, or a large collateral artery, originating near the opening by which the aneurism communicates with the main artery. Here he is not at all precise; and were he to tie the femoral artery immediately below the point, where the profunda arises, he would expose his patient to great danger of bleeding. I say this, well aware of the case which he has adduced to prove the contrary. In the example brought forward, he applied several ligatures: (p. 260.) some of which were the *ligatures d'attente*, or loose ligatures left ready to be tightened in case of need. These were of course higher up, than the ligature, which was tightened. It is therefore impossible, that this last could have been close to the origin of the profunda. There must have been room left for the application of the *ligatures d'attente*; and be it also recollected, that the French still persist in the use of large flat cords, and not small firm round ligatures, which are now found to be most advantageous. (See *Hemorrhage*.) In this part of the dictionary, we shall find, that the nearness of a collateral vessel impedes the formation of the internal coagulum, which has a material share in the process by which the artery is closed.

With respect to the circumstance of hemorrhage being more likely to follow, when the ligature is placed close below, than at some distance from a great collateral artery, there cannot be a doubt of the fact. Roux, when in London, saw an occurrence of this kind himself, and has published it in his book. It was a case, in which Mr. A. Cooper tied the external iliac artery; but the patient died of hemorrhage a fortnight afterwards, and on opening the body, it was ascertained, that the obturator artery, which usually arises either from the trunk of the internal iliac, or from the epigastric, proceeded from the external iliac, and arose immediately above the point, to which the ligature was applied. (See *Parallèle de la Chir. Angloise avec la Chir. Francoise*, &c. p. 278, 279.)

From a preparation, spoken of by Mr. Travers, and some experiments made by the same gentleman, it would appear, that the presence of a collateral branch hinders the formation of the internal coagulum, and will not always prevent the closure of the vessel by the adhesive inflammation. In the preparation referred to, a ligature was applied to the external iliac, between the epigastric and circumflex iliac arteries, "and having been in contact with the former at the angle which it makes at its origin from the iliac, ulceration had taken place, and the bleeding had proved fatal. There was no coagulum formed in the iliac trunk, though the operation had been performed several days, the circulation through the epigastric having continued. But the lymph-plug at the seat of the ligature on the iliac artery was complete." *Med. Chir. Trans.*

Vol. 6, p. 656.) Indeed, it must be allowed, with this gentleman, that the fluidity of the blood does not prevent the adhesive process, a fact, which, he observes, is also proved in the indirect obstruction of a vessel, by means of a temporary ligature or compressor. When, therefore, the vicinity of a large branch to the ligature is spoken of as a circumstance conducive to secondary hemorrhage, I mean, that it is so inasmuch as the internal coagulum is regarded as useful in promoting the closure of the vessel, and its formation is prevented.

Brasdor first, and afterwards the celebrated Desault conceived, that, when an aneurism was so situated, that a ligature could not be applied to the artery leading to the swelling, a cure might possibly arise from tying the vessel, on that side of the tumour, which was most remote from the heart. Desault conjectured, that by this means, the circulation through the sac would be stopped, the blood in it would coagulate, that the circulation would go on by the collateral arteries, and that the tumour would be finally absorbed. These speculations, however, were not found to answer in practice. Deschamps tied the femoral artery below an inguinal aneurism; but the progress of the disease, instead of being checked, seemed to be accelerated by this novel experiment. The operator was obliged, as a last resource, to open the tumour, and try to take up the vessel. In this attempt, the patient lost a large quantity of blood, and died eight hours afterwards. (See *Œuvres Chir. de Desault par Bichat*, Tom. 2, p. 563, and *Recueil Périodique de la Société de Médecine de Paris*, Tom. 5. No. 17.)

The operation of tying the artery below the tumour was some time ago repeated by Mr. A. Cooper, not for an aneurism of the femoral artery in the groin, but for an aneurism of the external iliac, where tying the artery above the swelling was impracticable. The femoral artery was therefore tied immediately below Poupart's ligament, between the origins of the epigastric and the profunda. The pulsations of the tumour continued; but, the progress of the disease was checked. After a time, indeed, the swelling decreased, and this in so considerable a manner, that hopes began to be entertained, that perhaps the external iliac artery might soon admit of being tied above the disease. The ligatures came away without any unfavourable occurrence, and when the wound was healed, the patient was sent into the country for the benefit of the change of air. The tumour, however, gave way, an extravasation of blood took place in the abdomen and cellular membrane of the pelvis, and the patient died. Mr. A. Cooper had no opportunity of seeing the case, and the body could not be opened, so that further particulars were not obtained.

The memorable instance, in which this gentleman tied the aorta, in a case of inguinal aneurism, extending very high up, and already burst, I shall notice under the head *Aorta*.

I shall finish these general observations on the treatment of external aneurisms, or such as admit more particularly of surgical treatment, with observing, that, in England, surgeons now lose few patients either from gangrene of the limb or secondary hemorrhage; and this notwithstanding they may sometimes prefer applying a ligature above the profunda to cutting open the aneurismal tumour. I firmly believe, that such matchless success is to be totally ascribed to the perfections in their mode of operating; the choice of a proper kind of ligature; the right plan of applying it; the rejection of the employment of several ligatures at a time; and the great care which is taken to promote the healing of the wound, as quickly as possible; the avoidance of all unnecessary and hurtful extraneous substances in the wound; and above all, the relinquishment of the formidable proceeding of cutting open the tumour.

In the consideration of particular aneurisms, I shall begin with those which may be cured by a surgical operation; and, here we shall be fully satisfied, that, "*l'art de guérir ne triomphe jamais plus heureusement que lorsqu'il peut employer la médecine efficace, c'est à dire, les moyens chirurgicaux ou opératoires.*" (*Clinique Chirurgicale*, Tom. 1, p. 110.)

OF THE POPLITEAL ANEURISM, AND OPERATION FOR ITS CURE.

Notwithstanding the solitary example in which M. A. Severinus, early in the 17th century, tied the femoral artery near Poupart's ligament in a case of aneurism, (*De Efficac. Med. Lib. 1, p. 2. c. 51.*) the practice of tying arteries, wounded either by accident or in the performance of surgical operations, and even the plan of tying the humeral artery for the cure of the aneurism at the bend of the arm, were known long before the operation for the relief of the popliteal aneurism was attempted. The considerable size of the femoral artery; its deep situation, the urgent symptoms of the disease, and ignorance of the resources of nature for transmitting blood into the limb, after the ligature of the vessel, are the circumstances, which appear to have deterred former surgeons from this operation.

Valsalva treated popliteal aneurisms on the debilitating method, and published one or two equivocal proofs of its success. In Pelletan's first memoir on aneurism, and in the third vol. of Sabatier's *Médecine Opératoire*, as I shall hereafter notice again, are two cases of axillary aneurisms, which were cured by Valsalva's treatment. But, encouraging as such examples may be, experience is not yet sufficiently favourable to this practice to allow it to bear a comparison, in point of efficacy, with the surgical operation, or to justify the general rejection of this last more certain means of cure. As Pelletan admits, Valsalva's treatment is extremely severe; the event of it doubtful

and should the plan fail, the patient might not be left in a condition to bear an operation, for the success of which it seems necessary, that a certain strength of vascular action should exist, in order that the blood may be freely transmitted through such arterial branches, as are to supply the places of the main trunk, after this last has been tied.

The time, therefore, has not yet arrived, when surgical operations for the relief of aneurisms should be relinquished. (*Pelletan, Clinique Chirurgicale, T. 1. p. 114.*)

The cure of popliteal aneurisms by means of compression is occasionally effected; but, it happens too seldom to claim a great deal of confidence, or to lessen in any material degree the utility and importance of operative surgery in this part of practice. Pelletan records the cure of one popliteal aneurism by compression and absolute repose, during eleven months (*T. 1. p. 115.*) Boyer relates two instances (*Traité des Mal. Chir. p. 204, T. 2.*); one is mentioned by Richerand (*Dict. des Sciences Méd. T. 2, p. 96.*); the practice of Dubois is said to have furnished several examples of the same success (*Vol. cit. p. 97.*); and a case, in which Dupuytren effected a cure by compressing the femoral artery by means of an instrument applied just above the place where the vessel perforates the tendon of the triceps muscle, is detailed by Breschet. (*Fr. Transl. of Mr. Hodgson's work, T. 1, p. 249, &c.*)

The circumstances, under which the employment of compression affords the best chance of success, have been already mentioned, as well as the prudence of assisting this plan with perfect quietude, venesection, spare diet, and cold astringent applications, especially ice, which was first recommended by Donald Monro, and has subsequently been most highly praised by Guerin.

Aneurisms in general, and, among them, the popliteal case, are all attended with some little chance of a spontaneous cure; yet this desirable event is too uncommon to be a judicious reason for postponing the operation, especially, as it is the usual course of the disease to continue to increase; while in the early stage the cure may be more speedily accomplished. In fact, the experience of modern operators leaves no room for apprehending, that the anastomoses will not suffice for the due nourishment of the leg and consequently proves, that waiting beyond a certain time for the enlargement of the collateral vessels to take place is altogether an unnecessary and disadvantageous method. Popliteal aneurisms, as well as other external tumours of the same nature, stand the best chance of a spontaneous cure, when any cause induces a general, violent, and deep inflammation all over the swelling; for, then the communication between the sac and artery is likely to become closed with coagulating lymph, and the pulsation of the tumour to be suddenly and permanently stopped. If in this state, the

disease sloughs, and the patient's constitution holds out, the coagulated blood in the sac and the sloughs, are gradually detached, leaving a deep ulcer, which ultimately heals. An example, in which a popliteal aneurism was cured by such a process, is related in the *Trans. of a Society for the Improvement of Med. and Chirurgical Knowledge, Vol. 2, p. 268.*

In former times, when all hopes of curing a popliteal aneurism by Valsalva's method, by compression, or a natural process, were at an end, amputation of the limb was considered as the sole and necessary means of saving the patient's life. But, about fifty years ago, the confidence of surgeons in the sufficiency of the anastomosing vessels or the continuance of the circulation began to increase, and, in opposition to the tenets of J. L. Petit, and Pott, experience soon proved, that, in general, not only might the patient's life be saved, but his limb also, and this, without any operation, that could be compared with amputation, in regard to severity. On looking back to the history of amputation, we shall find, that A. N. Guenault was one of the earliest writers, who disapproved of amputation, as not truly indispensable for the cure of popliteal aneurism.

It is alleged, that Teislere, Molinelli, Guattani, Mazotti, and some other celebrated Italian surgeons, were the first, who ventured to tie the popliteal artery for the cure of aneurism. The path, as Pelletan remarks, had been pointed out to them by Winslow and Haller, whose valuable descriptions and plates of the arterial anastomoses about the knee joint, showed by what means the lower part of the limb would be nourished, after a ligature had been placed on the principal arterial trunk. For almost thirty years, however, the practice of tying the popliteal artery was confined to the Italian surgeons. Pelletan believes, that he was the first, who attempted such an operation at Paris nearly thirty years ago, (alluding to about the year 1780, the *Clinique Chirurgicale* being dated 1810.)

However, this operation of opening the tumour and tying the popliteal artery itself, was a severe and often a fatal proceeding, and does not admit of being compared with the Hunterian operation, in point either of simplicity, safety, or success, as I shall explain, after the detail of a few particulars relating to the popliteal aneurism.

On whatever side of the artery the tumour is produced, it can be plainly felt in the hollow between the hamstrings, and in general its nature is as easily ascertained by the pulsation in every part of the tumour. Though the disease may not occur in the popliteal artery so often as in the aorta itself, it certainly is seen more frequently in the former vessel, than any other branch, which the aorta sends off. As Sir E. Home has observed, this circumstance has never been satisfactorily explained; and, what is rather curious, in many recent instances of this disease, the patients have been coachmen

and postillions. Morgagni found aneurisms of the aorta most frequent in guides, post-boys, and other persons, who sit almost continually on horseback; a fact, which he imputes to the concussion and agitation to which such persons are exposed. Some allusion to this subject has already been made in the foregoing pages. Whether an explanation of the frequency of popliteal aneurisms can be correctly referred to the obstruction, which the circulation in the artery must experience, when the knee is in a state of flexion, may be questioned, though it is on a similar principle, that the great frequency of aneurisms of the curvature of the aorta is attempted to be solved. (*Home in Trans. of a Society for the Improvement of Med. and Chir. Knowledge, Vol. 1, &c. and Monro in Ed. Med. Essays, Vol. 5.*)

Were this the only, or even the principal cause, surely one could have reason to expect aneurisms to be at least as frequent in the axilla, and at the bend of the elbow, as in the ham.

The popliteal aneurism was generally supposed to arise from a weakness in the coats of the artery, independently of disease. If this were true, we might reasonably conclude, that, except at the dilated part, the vessel would be sound. Then the old practice of opening the sac, tying the artery above and below it, and leaving the bag to suppurate and heal up, would naturally present itself. Mr. Hunter, finding, that the arterial coats were altered in the structure higher up, than the tumour, and that the artery, immediately above the sac, seldom united when tied; but, that, when the ligature came away, the bleeding destroyed the patient; concluded, that some disease affected the coats of the vessel, before the actual occurrence of the aneurism. Dissatisfied with Haller's experiments on frogs, showing that weakness alone could give rise to aneurism, he tried what would happen in a quadruped, whose vessels were very similar in structure to the human. Having denuded above an inch of the carotid artery of a dog, and removed its external coat, he dissected off the other coats, layer after layer, till what remained was so thin, that the blood could be seen through it.

In about three weeks, the dog was killed, when the wound was found closed over the artery, which was neither increased nor diminished in size.

It being conjectured, that the prevention of aneurism, perhaps, arose from the parts being immediately laid down on the weakened portion of the artery, Sir E. Home stripped off the outer layers of the femoral artery of a dog, placed lint over the exposed part of the vessel to keep it from uniting to the sides of the wound, and, in six weeks, killed the animal, and injected the artery, which was neither enlarged, nor diminished, its coats having regained their natural thickness and appearance.

These experiments strengthened Mr. Hunter's belief, that aneurismal arteries are diseased; that the morbid affection frequently

extends a good way from the sac along the vessels; and that the cause of failure in the old operation, arose from tying a diseased artery, which was incapable of uniting, before the ligature separated. These reflections led him to propose taking up the artery in the anterior part of the thigh, at some distance from the diseased portion, so as to diminish the risk of hemorrhage, and be enabled to get at the vessel again, in case it should bleed. The stream of blood into the sac being stopped, he concluded, that the sac and its contents would be absorbed, and the tumour gradually disappear, so as to render any opening of it unnecessary.

The first operation of this kind, ever done, was performed on a coachman, by Mr. Hunter, in St. George's Hospital, December, 1785. An incision was made on the anterior and inner part of the thigh, rather below its middle, which wound was continued obliquely across the inner edge of the sartorius muscle, and made large, in order to facilitate doing whatever might be necessary. The fascia, covering the artery, was then laid bare, for about three inches, after which the vessel itself could be felt. A cut, about an inch long, was then made through the fascia, along the side of the artery and the fascia dissected off. Thus the vessel was exposed. Having disengaged it from its connexions with the knife and a thin spatula, Mr. Hunter put a double ligature under it, by means of an eye-probe. The doubled ligature was then cut, so as to make two separate ones. The artery was now tied with both these ligatures, but, so slightly as only to compress the sides together. Two additional ligatures were similarly applied a little lower, with a view of compressing some length of artery, so as to make amends for the want of tightness, as it was wished to avoid great pressure on any one part of the vessel. The ligatures were left hanging out of the wound, which was closed with sticking plaster. On the second day, the aneurism had lost one third of its size, and, on the fourth, the wound was every where healed, except where the ligatures were situated. On the ninth, there was a considerable discharge of blood from the apertures of the ligatures, but it ceased on applying a tourniquet, and did not recur. On the fifteenth day, after the operation, some of the ligatures came away, followed by a small quantity of matter, and about the latter end of January 1786, the man went out of the hospital, the tumour having become still less. In the course of the spring, abscesses in the vicinity of the cicatrix followed, and some pieces of ligature were occasionally discharged. In the beginning of July, a piece of ligature, about one inch long, came away, after which the swelling went off entirely, and the man left the hospital again on the 8th, perfectly well, there being no appearance of swelling in the ham. This subject died of a fever in March, 1787, and, on dissection, the femoral artery was found impervious from the giving off of the arteria profunda down to the place

of the ligature, and an ossification had taken place for an inch and a half along the course of this part of the vessel. Below this portion, the vessel was pervious, till just before it came to the aneurismal sac, where it was again closed. What remained of the sac was somewhat larger than a hen's egg, and it had no remains of the lower opening into the popliteal artery. The rest of the particulars of this dissection are very interesting. (See *Trans. of a Society for the Improvement of Med. and Chir. Knowledge*, Vol. 1, p. 153.)

This celebrated case completely established the important fact, that simply taking off the force of the circulation is sufficient to cure an aneurism, as the tumour is afterwards diminished and removed by the action of the absorbent vessels.

In order to confirm the same fact, Sir E. Home related a case of femoral aneurism, which got well without an operation, but, on a similar principle, to what occurs, when the artery is tied. A trial of pressure had been made without avail. The tumour became very large, and such inflammation took place in the sac and integuments, that mortification was impending: no pulsation could now be felt in the tumour, or the artery above it. The correct inference of Sir E. Home was, that a coagulum, which we know always occurs in an artery previously to mortification, seemingly to prevent bleeding, had formed in this instance, and in conjunction with the effusion of coagulable lymph about the root of the aneurism, had kept the blood from entering the sac.

Mr. Hunter's second operation was on a trooper. Instead of using several ligatures, which were found hurtful, he tied the artery and vein with a single strong one; but, unluckily, the experiment was made of dressing the wound from the bottom, instead of attempting to unite it at once: and the event was, that the man died of hemorrhage.

After this case, Mr. Hunter's practice was to tie the artery alone with one strong ligature, and unite the wound as speedily as possible.

Having recorded Mr. Hunter's cases, which first established the present method of operating for the cure of popliteal aneurisms, I shall not repeat the strong reasons which exist against the employment of reserve-ligatures, metallic compressors; two ligatures, with the division of the vessel between them; the interposition of pieces of linen, wood, cork, agaric, &c. between the knot and the vessel; for the use of large ligatures; and other contrivances, the merits, or rather demerits, of which have been already fully considered in the preceding section. My next duty is to explain the method of performing the Hunterian operation, as brought to its modern state of improvement, and adapted to the wise principles, which first emanated from the valuable experiments and investigations of Dr. Jones. (See *Hemorrhage*.)

In the arrangement of the assistants, one of them should be so placed, that if re-

quired, in consequence of any accidental wound of that vessel in the operation, he can compress the femoral artery as it passes over the brim of the pelvis; but, as Scarpa justly observes, no pressure of this kind is to be made, unless the accident referred to should happen, because the pulsations of the artery, inasmuch as they indicate the track of the vessel, must tend materially to facilitate the operation. The surgeon, says Scarpa, is to explore with his forefinger the course of the artery from the crural arch downwards, and when he comes to the place, where the vibration of this vessel begins to be less distinctly felt, this point is to be fixed upon for the lower end of the external incision. This angle of the wound will fall nearly on the inner edge of the sartorius, just where this muscle crosses the track of the femoral artery, and at the very apex of the triangle formed by the convergence of the triceps and vastus internus. A little more than three inches above the place here fixed upon, the surgeon is to begin with a convex-edged bistoury, the incision through the integuments and cellular substance, and carry the wound down the thigh, in a slightly oblique line, from without inwards, so as to make it follow the course of the artery, as far as the apex of the above-mentioned triangular space, or the point where the vessel passes under the inner edge of the sartorius muscle. In order to make this first external incision with correctness, I consider it a good rule always to take particular notice of the line described by the sartorius on the thigh, the inner margin of which muscle at the place where it meets the artery, as we have seen, forms at once the lower boundary of the incision, and an important guide to the vessel itself. By observing the track of the sartorius attentively, we shall likewise avoid all chance of making the wound too low down, so as to have this muscle intervening between the incision and the artery; a greater source of embarrassment in the operation, and of troublesome consequences afterwards than, perhaps, any other error; for, when this has happened, and the surgeon has not room enough afforded by the higher part of the wound to get at the artery above the sartorius, he is compelled to dissect and raise up this muscle from its natural connexions, ere he can plainly discover the vessel. This inconvenience made a deep impression on me in the first case, where I tied the femoral artery, for the intervention of the sartorius in a stout soldier, upon whom the operation was done, threw me into the dilemma of either dissecting at the outer edge of this muscle and drawing it inwards, or of enlarging the wound upwards. The latter proceeding was that to which I gave the preference, because it seemed to me an excellent maxim in this operation, to avoid making any further detachment of parts from their natural connexions, than is absolutely necessary, and I knew, that when the wound was extended a little higher up, the artery would present

itself more superficially, quite unconcealed by any muscle, whatever. Strongly, therefore, as my principles have led me to condemn Scarpa's modification of the ligature, his use of from four to six threads, and his interposition of a roll of linen between the knot and the vessel, I feel pleasure in expressing my conviction of one excellence in his mode of operating; an improvement, which is now obtaining, if it has not already obtained, the universal approbation of the surgical profession. This amendment consists in making the incision in the upper third of the thigh, or a little higher, than the place, where Mr. Hunter used to make the wound. Scarpa's reason for this practice is to avoid the necessity of removing the sartorius muscle too much from its position, or of turning it back, to bring the artery into view, so as to be tied. I have seen the best operators, even professors of anatomy, embarrassed, by having the sartorius muscle immediately in their way after the first incision, and as the vessel is more superficial a little higher up, the place is further from the diseased part of the artery, and there is no hazard of the anastomoses failing to keep up the circulation; this part of Scarpa's practice is highly deserving of imitation.

"The part of the limb (observes Mr. Hodgson,) in which the femoral artery can be tied with the greatest facility, is between four and five inches below Poupart's ligament. The profunda generally arises from the femoral artery an inch and a half, or an inch and three quarters, below Poupart's ligament; it very rarely arises so low as two inches. If, therefore, the ligature be applied to the femoral artery at the distance of four or five inches below Poupart's ligament, the surgeon will not be embarrassed by meeting with the profunda during the operation, and the chance of causing secondary hemorrhage, by tying the artery close to the origin of this vessel, will be obviated." (*On the Diseases of Arteries, &c.* p. 434.)

The trouble, arising from cutting too low down, so as to have the sartorius intervening between the outer wound and the artery, may be more accurately estimated, when it is known that Desault, for the removal of this inconvenience considered it right actually to make a complete transverse division of that muscle, a thing, which, it is said, may be done, without any ill consequences. (*Boyer's Traité des Mal. Chir.* T. 2, p. 145.) I shall not presume, however, to second this last piece of advice, because, though it may have been done by Desault, it appears to me, that the artery can always be taken up very well, without the proceeding here recommended.

A few years ago, Mr. C. Hutchinson published a tract, in which he advocated the practice of making the incision at the outer edge of the sartorius, and then raising that muscle, and drawing it inwards, in order to arrive at the artery. This advice proceeded from the apprehension, that the plan of

taking up the femoral artery at the inner edge of the sartorius was attended with risk of injuring the saphena vein, and large lymphatics. (*Letter on the Operation for popliteal aneurism, 1811.*) The same method is commended by Boyer, and Roux, (*Nouveaux Elémens de Méd. Opératoire, T. 1. p. 729*) when the operation is done low down in the thigh. But, as operating in this situation is liable to the several objections of approaching too near the disease, of aiming at taking up the artery where it lies more deeply, than it does higher up, and, of every inconvenience which may arise from the interposition, dissection, and reflection of the sartorius muscle, the method must be rejected, unless it can be proved, that so many disadvantages are fully counterbalanced by other considerations. If the plan which I shall presently recommend be adopted, there will never be the slightest risk of wounding the saphena vein; and, therefore, I do not consider it advisable or necessary, for the avoidance of this accident, to make the wound *precisely upon the sartorius*, as my intelligent friend Mr. Hodgson suggests; a method, attended with the inconvenience of having the fibres of that muscle between the external wound, and the artery, and perhaps inconsistent with the excellent directions which he afterwards delivers, concerning the right mode of performing the external incision, when he says, with Scarpa, that this cut should be "continued down to the fibres, which form the inner margin of the sartorius." (*On Diseases of Arteries, &c.* p. 436.)

Now, if the point where this margin first lies over the artery, be the proper place for the lower termination of the external incision, we shall clearly be deviating from the precise course of the vessel by letting the higher portion of the wound be over the fibres of that muscle. And, when it is further reflected, that the serious evils of wounding the trunks of the lymphatics in this operation are not demonstrated in modern practice, while the saphena vein may always be avoided with certainty and facility, I cannot admit, that there is any solid reason for letting the situation and direction of the external wound be determined by such apprehensions. At all events, for the motives above explained, it should be a fixed maxim in this operation never to extend the wound lower than the point, where the inner margin of the sartorius crosses the artery; and then all detachment and displacement of this muscle will be unnecessary, and every embarrassment, which might proceed from its interposition between the outer wound and the artery, will be completely avoided.

The skin and cellular substance are to be divided, in the situation, and to the extent above specified down to the femoral fascia, under which the artery lies, and may be felt beating. The next object, therefore, is to divide the fascia, which is here much thinner than at the outer side of the limb, and may be cut with another stroke of the bistoury;

or (what is safer with the view of abstaining from all chance of wounding the artery) a slight cut may first be made in the fascia, the division of which may then be made to the requisite extent by introducing under it a grooved director, on which the further incision may be made with perfect security. The fascia is to be divided in the direction of the external wound; but, to what extent is a point on which surgical writers differ, and, indeed, they must here differ, as long as they are not unanimous about the method of applying the ligature round the artery; because, if it be intended to use a broad ligature, with a cylindrical piece of linen interposed between it and the artery, or especially if it be designed to apply two ligatures and divide the vessel in the interspace, more of the artery must be exposed, and of course more of the fascia must be cut, than when it is simply meant to surround the vessel with a single small ligature. Such operators also as have contracted the pernicious habit of insulating the artery all round sufficiently far to let them thrust their finger under it, will likewise require an extensive opening in the fascia. Such detachment of the vessel for an inch or more, for the purpose of placing the finger under it, is a measure which deserves to be condemned in the strongest terms, as it is the very thing, which produces some risk of injuring the saphena vein, and has a tendency to bring on secondary hemorrhage, inasmuch as it occasions unnecessary handling, stretching, and disturbance of the artery and surrounding parts, and an inevitable division of the vessels, by which the arterial coats are supplied with blood.

According to Mr. Hodgson, the extent of the cut in the fascia should be about an inch; for he wisely avoids all unnecessary separation of the artery from its surrounding parts. On the contrary, Scarpa, who insulates and raises the vessel, previously to tying it, insists upon the prudence of cutting the fascia, the whole length of the external wound; for, says he, if this practice be neglected, it most frequently happens, that, in the succeeding inflammatory stage, the bottom of the wound swells and becomes very tense, and the matter, which is formed under the fascia, not finding a ready exit, occasions abscesses which seriously retard the cure. But, Scarpa, instead of planning a method of relieving the consequences, might have employed himself more to the purpose in considering how they were to be prevented, and why in his method they most frequently happen. Now, without laying any stress upon two waxed ligatures, each composed of six threads, with an additional extraneous substance, viz. a roll of linen in the noose, we should be more surprised to hear, that the wound after his method did not become affected with swelling, tension, and suppuration, than that these were the usual effects. After describing the division of the fascia, he observes; "*With the point of the forefinger of the left hand, already touching the femoral*

artery, the surgeon will separate it from the cellular substance, which ties it laterally and posteriorly to the contiguous muscles; and making the point of the same finger pass gradually under and behind the femoral artery (supposing the surgeon has not enormously large fingers) he will raise it alone from the bottom of the wound, or (when it cannot be avoided) along with the femoral vein. If it is along with the femoral vein, the surgeon, holding the artery and vein thus raised, and almost out of the wound, will cautiously separate the vein from the artery with a bistoury, or spatula, or simply with his fingers, &c." (See Scarpa on Aneurism, p. 280, Ed. 2.)

When we combine the irritation and mischief of all this work with the ill effects of filling the bottom of the wound with soft lint, I would ask, what more certain plan could Scarpa, or any other person, have suggested for bringing on the unpleasant state of the wound, which he describes as most frequently taking place?

I shall suppose the fascia has now been divided, under which the surgeon distinctly feels the pulsations of the femoral artery, which is still invested by the cellular sheath. The femoral vein lies directly under this vessel, while the branches of the anterior crural nerve, separated from it by dense cellular substance, are more externally, yet somewhat more deeply situated. The next object, therefore, is to pass a single ligature round the artery, without including, or, in any manner meddling with the subjacent femoral vein, or, detaching and disturbing the artery. For this purpose, the best direction is that given by my friend, Mr. Lawrence: "after dissecting down to the artery, a slight scratch or incision may be made through the sheath, close to the side of the vessel. Then, with a narrow aneurism needle, nearly pointed at the end, and made as thin at its edge as it can be without cutting, a single silk ligature is to be conveyed round it, the point of the needle being kept in contact with the artery. A needle of this form makes its way easily through the cellular substance, and the vessel is detached only in the track of the instrument." (See *Med. Chir. Trans.* Vol. 6.)

Of the kind of ligature to be employed, I need only say here, that it should be a single one, composed of firm materials, in order to avoid the necessity for increasing its diameter more than would be desirable, for reasons elsewhere considered. (See *Hemorrhage and Ligature*.) The ligature having been put under the artery, one end of it is to be drawn completely through the track made for it by the needle, which instrument is then to be taken away, leaving the ligature under the vessel. The ligature is now to be tied in a steady firm manner, but without any immoderate force, which can never be necessary even for the division of the inner coats of the vessel. In this part of the operation, a few practitioners give the preference to what is termed the *surgeon's knot*, and commend this plan of fastening the ligature; a plan, which con-

tists in putting the end of the cord twice through the noose, before the constriction is made. The only good of the surgeon's knot is, that it does not so readily slip and loosen as a common one; but Scarpa thinks a simple knot best, as it does not, like the other, prevent the surgeon from calculating the force, with which the artery is constricted. (*On Aneurism*, p. 281, *Ed. 2.*) And, besides this reason against the surgeon's knot, another objection to it is the irregularity, with which a ligature in this form will lie round the vessel. A simple noose should therefore be first made and tightened, and then a second one, so as to form a common knot; and, now, as a matter of precaution against the possibility of the ligature slipping and becoming loose, the surgeon, if he pleases, can tie the knot once again. One end of the ligature is next to be cut off near the knot; and the sides of the wound are to be brought together with strips of adhesive plaster, the irritation of sutures being carefully avoided. The remaining end of the ligature should always be brought out at the nearest point of the external wound to the knot on the artery.

The effects, which in general immediately follow the operation, are a total cessation of the pulsation of the aneurismal tumour, a manifest sinking and flaccidity of the swelling; a diminution of pain in the seat of the disease; and a strong vibration of the articular arteries round the knee. As Mr. Hodgson has remarked, the unusual influx of blood into the minute ramifications, when a main artery is suddenly rendered impervious, is generally attended with a remarkable increase in the temperature of the limb. After tying the femoral artery for the cure of popliteal aneurism, the same phenomenon occurs, at least after a short time, during which the temperature of the leg and foot frequently continues lower, than that of the sound limb. But, in a few hours, it generally rises, and is sometimes several degrees higher, than that of the opposite member. This state lasts several days, at the end of which time, the heat of the limb, which has been operated upon, will be found to be about the same as that of other parts of the body. (*Hodgson on Diseases of Arteries*, &c. p. 256.) It is only while the limb is colder than natural, that it ought ever to be fomented, or covered with flannel. In particular examples, there is no increase of temperature in the limb at any period after the operation; a fact, which Mr. Hodgson refers to the probability of a collateral circulation having already been established, in consequence of the obstruction to the passage of the blood through the main artery by the accumulation of the coagulum in the aneurismal sac. Of course, unless a collateral circulation be established, the operation cannot succeed, as the limb will mortify: it behoves us, therefore, to be aware of the circumstances, which may prevent the due transmission of the blood to the inferior part of the limb. These are ably explain-

ed and commented upon in Mr. Hodgson's work; 1st, An extensive transverse wound, by which the principal anastomosing branches are divided. 2dly, Tight bandages, and pressure, operating so as to obstruct the same vessels. 3dly, The immense bulk of the tumour, and the pressure upon the principal collateral arteries. 4thly, Calculous depositions in the coats of the arteries of the limb. 5thly, Advanced age. 6thly, A languid state of the circulation; a fact, indicating the wrongness of venesection; as a general practice after the operation, though it may yet be right to adopt this treatment, where the pulsations return in the tumour with unusual strength, and appear to stop the diminution of the swelling, as already mentioned. 7thly, The abstraction of heat from the limb by cold evaporating lotions; a plan, which can only be right, when there is a great increase of heat in the limb, a tendency to inflammation, or a return of strong pulsations in the tumour.

When the operation is done, according to the principles laid down in this article, the patient is not too old, nor enfeebled, and the after-treatment is properly conducted, mortification may now be said to be a rare event. I have seen but one example of gangrene, and in that, only one toe, and a portion of the skin of the instep, sloughed in a very debilitated subject. This partial gangrene of the foot has been particularly noticed by Deschamps and Scarpa, the latter of whom regards it as an unusual thing, only likely to happen in old, weak, or unhealthy subjects; and "at any rate," (says he,) if this should happen in any of these enervated individuals, the patients may console themselves for the loss of one, or two of their toes, with the cure of a popliteal aneurism, and the avoidance of a painful and dangerous incision in the ham, and of the tedious suppuration, which would have followed it."

When the operation succeeds, a considerable portion of the artery above the aneurismal tumour is rendered impervious, the vessel indeed being sometimes converted into a solid cord from the origin of the profunda to that of the tibial arteries. (*A. Cooper, Med. Chir. Trans. Vol. 2, p. 364.*) In general, however, the obliteration of the artery is less extensive; a fact particularly noticed in one of Mr. Hunter's cases, (*Trans. of a Soc. for the Improvement of Med. and Chir. Knowledge, Vol. 1, p. 153.*) and vainly urged by Deschamps, as a proof of the insufficiency of the new method. (*See Observations et Reflexions sur la Ligature des principales Arteres blessées et particulièrement sur l'Aneurisme de l'Artère poplitée*, p. 76. Paris, 1797.) It appears from the observations of Mr. Hodgson, that the artery generally becomes impervious, for the space of three, or four fingers' breadth, at the place where the ligature is applied; below which part its tube is unclosed, and continues so for some distance, when the obliteration again commences, and descends along a

considerable extent of the popliteal artery to the origin of the inferior articular, or tibial arteries. Thus, says this author, an insulated portion of the femoral artery preserves its cavity, from each of which considerable anastomosing branches arise: the upper branches convey blood into the vessel, and the lower transmit it into anastomosing channels, that originate below the knee. (*On Diseases of Arteries, &c. p. 278.*) Now, as Mr. Hodgson is unacquainted with any case, except that recorded by Mr. A. Cooper, where after the modern operation, the artery was obliterated from the seat of disease in the ham to the part, at which the ligature was applied, he thinks it probable, that, in most instances, a double collateral circulation exists in the limb, after this method of cure.

In consequence of the motion of the blood being more or less impeded in the aneurismal sac by the application of the ligature to the femoral artery, the aneurismal cavity soon becomes completely filled with coagula, which even block up the adjoining portion of the arterial tube. The coagulated blood in the sac is afterwards absorbed; and a gradual diminution, and final disappearance of the aneurism in the ham ensue; with the exception of a slight induration, which sometimes remains, composed of a remnant of the sac itself, or of the fibrous part of the blood. This slight hardness, which occurs in the bottom of the cavity of the ham, occasions no inconvenience, and does not hinder the patient from performing the motions of the knee and leg with quickness and safety. (*Scarpa, p. 257, Ed. 2.*)

When the advantages of the foregoing method of operating are contrasted with the dangers and severity of the practice of laying open the aneurismal tumour, and applying ligatures round the diseased part of the vessel, it is surprising to find any living surgeons still expressing a preference to the latter mode of treatment under any circumstances whatsoever. Yet, Boyer, Roux, and a few of the modern French surgeons are in this way of thinking, which reminds me of their slowness to adopt, at every opportunity, union by the first intention, one of the greatest and most decided advances to perfection ever made in the practice of surgery. The severity and difficulties of the old method of operating, in cases of popliteal aneurism, are most faithfully depicted by Scarpa. In the ham, says he, the artery lies very deep. The space is limited and narrow, within which it can be brought into view and tied, without risk of tying along with it, or of destroying, some of the principal anastomoses formed by the articular arteries of the knee. On account of the depth of the artery, it is difficult to pass any instrument round it, without including other parts, and it is no less difficult to draw the ligature on the vessel with a proper degree of tightness. Scarpa then comments on the disadvantages of tying the lacerated, diseased part of the vessel, which is sometimes so high up, that, in order to apply the

ligature above it, it is necessary to cut through the long head of the triceps, and make a passage through into the thigh. Or, the diseased, or lacerated part of the artery is situated so low down in the calf of the leg, that it is impossible to avoid including, either in the incision, or the ligature, the lower anastomosing articular arteries, on the preservation of which the circulation and life of the subjacent part of the limb in a great measure depend. We must add to all this the violence, which must be done to the great sciatic nerve, which an assistant must hold drawn to one side of the wound nearly the whole time of the operation. The proceeding is also liable to other great difficulties, as may be seen from a case reported by Masotti, (*Dis. sul Aneurysma, p. 53.*) where the popliteal artery was so firmly united, and, as it were, confused with the vein, the nerve, the tendons of the neighbouring muscles, and the periosteum, that the cavity of the ham presented the appearance of an intricate mass of parts, not easily separable from one another. Lastly, the operation leaves a large deep wound, laying open the whole cavity of the ham, and followed by copious suppuration, sinuses, and necrosis of the heads of the femur and tibia. If the patient be not hurried into his grave by these affections, and even if the parts in the ham heal, the patient is almost always left with an incurable contraction of the knee, and perpetual lameness. Thus, Masotti (*Op. cit. p. 17.*) relates one case, where the subsequent effects were such as to destroy the soft parts in the cavity of the ham, in such a degree, as not to leave any vestige of artery, vein, or sciatic nerve, and the patient remained all the rest of his life with a paralytic leg, and ulcers and fistulæ all round the knee. (*Scarpa on Aneurism, p. 251-253, Ed. 2.*)

I shall now advert to a few facts in the history of surgery, which eventually led to the bold and successful operations, adopted in modern times, for the cure of aneurisms of the femoral and popliteal arteries. The earliest case, of which the particulars are recorded, amounting to a satisfactory proof, that the lower extremity might be duly supplied with blood, notwithstanding the femoral artery had been tied high up in the thigh, is the example, related by M. A. Severinus, of a false aneurism of the thigh, about eight fingers' breadth below the groin, caused by a musket-ball wound. In this instance, Severinus tied the femoral artery above and below the aperture in it, and not only was the patient's life saved, but the use of the limb also preserved. (*Chirurgie Efficacis, P. 2. Enarratoria.*) The next authentic case of the ligature of the femoral artery, is that reported by Saviard, where M. Bottentuit, in 1688, tied this artery on account of a false aneurism, the result of a sword wound at the inner and upper part of the thigh. The surgeons, called into consultation, were immediately convinced, that the only thing to be done was

to take up the femoral artery; but, they were fearful, lest the patient should perish of bleeding, ere the opening in the vessel could be found, and, in case the artery were secured, they apprehended the obstruction of the circulation would be followed by mortification of the limb. The patient was therefore first prepared for his fate by the administration of the sacrament. A band was then applied round the upper part of the limb, and tightened by means of a stick, with which it was twisted, a piece of pasteboard being put under the knot, in order to render the constriction less painful. The tumour was then opened, the clotted blood extracted, and the opening in the artery detected by slackening the tourniquet. A curved needle, armed with a double ligature, was then introduced under the femoral artery, and one of the cords was tied above, and the other below, the wound in the vessel. Then follows a curious passage, showing the operator's judgment at that time, respecting the impropriety of interposing any cylinder of linen between the knot of the ligature and the artery, as some of the old surgeons at that time used to do, as well as a few of the moderns. "*On ne mit point de petites compresses sur le corps de l'artère au dessus du nœud, comme font quelques uns, parceque l'on jugea qu'il étoit d'une grande consequence, de lier tres-étroitement une artère si considerable, ce que l'on n'auroit pas été sûr de faire en interposant la petite compresse, &c.*" For greater security, assistants, who relieved each other in turn, kept up constant pressure on the tied part of the vessel for twenty-four hours. In six weeks, the patient recovered, and afterwards enjoyed such good health, that he went through several campaigns. (*Saviard, Nouveau recueil d'Observations Chir. Obs. 63, 12mo. Paris, 1702.*)

Now, with respect to these two cases, it merits attention, that, though Heister, Morgagni, and others, endeavoured to explain the success, by supposing, that each of the patients in question must have had two femoral arteries, both Severinus, and Saviard, were wise enough to avoid making any such erroneous inference themselves. At a later period, Guattani laid bare the femoral artery, as it passed under Poupart's ligament, compressed it against the ramus of the pubes, by means of graduated compresses, retained with a firm roller, and thus obtained the speedy obliteration of the vessel, and cured the aneurism, which had been first injudiciously opened. (*De Externis Aneurysmatibus, Hist. 15, 4to Romæ. 1772.*) In the same book is given the case of an inguinal aneurism, which when it had continued three months, and become equal in size to a large fist, was attacked with gangrene, whereby the aneurismal sac was quickly destroyed, and the femoral artery was obliterated for a considerable extent from the crural arch downwards. The sloughs were thrown off, however, and the ulcer had in a great measure healed, when the patient fell a victim to debility. (*Hist.*

17.) Here it is to be remarked, that, during the five weeks this man lived after the obliteration of the femoral artery, above the origin of the profunda, not only the circulation and life of the whole limb were preserved, but the auxiliary arteries, coming from within the pelvis, proved capable of limiting the progress of the mortification of the parts round the aneurism, and of commencing the healing process, in a manner, which raised great hopes of a cure. A similar fact is also recorded by Dr. Clarke. (*Duncan's Med. Comment. Vol. 3.*)

These, and other cases, which might be quoted, furnished ample proof of the efficiency of the anastomosing vessels in the support of the limb, though the femoral artery had been tied, or obliterated in a very high situation.

Besides these facts, surgeons derived every encouragement to attempt the cure of popliteal aneurism, by the ligature of the artery above the tumour, from the elucidations given by Winslow and Haller concerning the numberless anastomoses, which exist between the upper and lower articular arteries. Haller even drew the conclusion, that, if the course of the blood were intercepted in the popliteal artery, between the origins of the two orders of articular branches, such anastomoses would suffice for carrying on the circulation in the leg. And at length, Heister, weighing the anatomical observations of Winslow and Haller, and the facts recorded by Severinus and Saviard, first proposed applying to popliteal aneurisms, an operation, which, with the exception of those two cases, had until that time been restricted chiefly to aneurisms of the brachial artery. (*Dis. de genium Structuræ eorumque morbis. Disp. Chir. Halleri, T. 4.*)

It was in Italy that the earliest operations were undertaken for the cure of popliteal aneurisms, by Guattani or rather by a German surgeon, named Keysler, as would appear from a letter written by Testa, to Cotunni. (*See Pelletan's Cliniqui Chir. T. 1.*) The success, obtained by those surgeons, soon emboldened others to imitate them, and by degrees the practice of tying the femoral artery became common both in cases of aneurism and wounds; and from the observations of Heister, (*Haller Disp. Chir. T. 5.*) Acrell, (*Murray de Aneurysm. Femoris.*) Leslie, (*Edinb. Med. Comment.*) Hamilton, (*B. Bell's Surgery, V. 1.*) Burschall, (*Med. Obs. and Inq. Vol. 3.*) Leber, (*Dehaen, Ratio Medendi, T. 7.*) and Jussy, (*Ancien. Journ. de Med. T. 42.*) it was proved beyond the shadow of a doubt, that the circulation might continue in the limb, after the obliteration of the femoral artery, whether such obliteration were effected by direct pressure, or the ligature.

The exact period when the first operation of laying open the tumour and tying the popliteal artery, was performed in England, is not, as far as I know, particularly specified. However, judging from the observations made on this practice in the writings

of Pett, (*Remarks on Palsy, &c. 8vo. Lond. 1779.*) of Wilmer (*Cases and Remarks in Surgery, 8vo. Lond. 1779.*) of Kirkland (*Thoughts on Amputation, 8vo. Lond. 1780.*) and of others, it is clear, that this method of treatment had been often done in this country earlier than the dates of those works, and as would appear with little, or no success. The earliest attempt of this kind in France was made by Chopart in 1781, (*Roux, Nouveaux Elemens de Med. Operatoire, T. 1, p. 556.*) about five and twenty years after the examples set by Guattani in Italy; but Chopart failed in his endeavours to repress the bleeding from the exposed cavity of the tumour, and was therefore obliged to amputate the limb. Subsequently to this attempt, the operation was undertaken by Pelletan in two instances, the terminations of which were successful: consequently, this surgeon may be regarded as entitled to the honour of having proved to his countrymen the possibility of curing the popliteal aneurism by laying open the tumour, and securing the artery in the ham.

The severity and frequent ill success of this method of operating I have already noticed, nor shall I repeat the objections to it. With respect to the Hunterian practice, the great peculiarities of which were tying the artery at some distance above the disease, and not opening the swelling at all, Richerand seems offended, that Hunter's name should be affixed to an operation, which he conceives was in reality the invention of Guillemeau. Here we observe, *Ætius* again puts in a prior claim, and with much more effect, because the method, of which he speaks, truly resembled Mr. Hunter's, inasmuch as the vessel is directed to be tied at some distance above the swelling, while Guillemeau only tied the artery close above the disease, and opened the swelling, a serious deviation from the Hunterian practice.

Guillemeau, a contemporary, and disciple of Ambrose Paré, having to treat an aneurism, at the bend of the arm, the consequence of bleeding, exposed the artery above the tumour, tied this vessel, then opened the sac, took out the coagulated blood, and dressed the wound, which healed by suppuration. After more than a century, Anel, on being consulted about a similar case, tied the artery above the swelling, which was left to itself. The pulsations ceased, the tumour became smaller, and hard, and after some months, no traces of the disease were perceptible.

In 1785, Desault operated in the same manner for a popliteal aneurism: the swelling diminished by one half, and the throbbings ceased: on the 20th day, it burst, coagulated blood and pus were discharged in large quantities, and the wound, after continuing a long time fistulous, at length healed. Towards the end of the same year, says Richerand, Hunter applied the ligature somewhat differently; instead of placing it close to the swelling or directly above it,

he put it on the inferior part of the femoral artery. (See *Nosogr. Chir. T. 4, p. 98, 99, edit 2.*)

Unquestionably, Anel did, in one solitary instance, tie the humeral artery immediately above an aneurism at the bend of the arm, and effected a cure without opening the swelling. (*Suite de la Nouvelle Méthode de guérir les fistules lachrymales, p. 251, Turin, 1714;*) but he did not think of applying the plan to the femoral artery, or draw the attention of the French surgeons sufficiently to the matter, to make the latter imitate his operation; on the contrary, the method fell into oblivion, and was never repeated. With regard to Desault's operation, said to have been done in an earlier part of 1785, than Mr. Hunter's first operation, it is only necessary to say, that Desault tied the popliteal artery itself, while the grand object in Mr. Hunter's method was to take up the femoral artery, at a distance from the disease, and that it is this last mode alone, which has gained such approbation, and been attended with unparalleled success.

The French surgeons have not practised the Hunterian operation with the same degree of success, with which it is now performed in England, and, consequently, they very commonly pursue the old method of opening the sac, &c. Even professor Boyer avers his relinquishment of what he calls Anel's plan. (*Traité des Mal. Chir. T. 2. p. 148.*) But, we shall not be surprised at their ill success, when we hear that they neglect the right principles, on which ligatures ought to be applied to arteries, as explained by Dr. Jones in his work on hemorrhage. Even Baron Dupuytren adheres to the use of ligatures of reserve; and Boyer applies four loose ligatures round the artery, besides two tight ones; and consequently a large portion of the vessel lies separated from its natural connexions, and irritated by these extraneous substances. Hunter's first operation nearly failed also on account of so many ligatures, none of which were tightened so as to cut through the inner coats of the artery, and thus promote its closure. (See *Hemorrhage.*) In reference to the operation for popliteal aneurism, *Rosenmüller's Chir. Anat. Plates* deserve to be consulted, *Part 3, Tab. 8 & 9.* Scarpa's matchless engravings, and Haller's *Icones*, should likewise be examined.

ANEURISMS OF THE LEG, FOOT, FOREARM, AND HAND.

Doubts were not long ago entertained, respecting the possibility of curing an aneurism at the upper part of the calf of the leg by tying the femoral artery in the middle of the thigh. (*Istituto Ital. di Scienze ed Arti. Vol. 1, Parte 2, p. 266.*) The author, here referred to, was led by this uncertainty to have recourse in one instance to the severe method of laying open the tumour, in order to get at the vessel lower down. On this case, Scarpa

makes some correct reflections; the operator (says he) assured himself, that, on compressing the femoral artery at the upper part of the thigh, the tumour at the top of the calf ceased to pulsate; and that, when the compression was continued for some time, the swelling partly disappeared, and became softer. It ought to have been evident, therefore, that the aneurism might have been cured by tying the trunk of the femoral artery, as described in the foregoing section. In Scarpa's work is a case, in which an aneurism at the bifurcation of the popliteal artery was cured by the ligature of the femoral artery. (See p. 461, Ed. 2.) Mr. Hodgson has seen three aneurisms, situated at the commencement of the tibial arteries, cured by the same operation. (*On Diseases of Arteries, &c.* p. 437.) But, as Scarpa remarks, though the Hunterian operation answers in the cure of aneurism in the bend of the arm, and at the upper part of the calf of the leg, it is not so effectual for aneurisms situated on the back or palm of the hand, or the dorsum, or sole of the foot. The free communication, which the ulnar and radial arteries keep up with each other in the hand, and the tibial arteries have in the foot, prevent the operation from succeeding, whether the brachial, or femoral artery, or one of the two large arteries of the forearm, or leg, be tied. In proof of this statement Scarpa cites two cases of aneurism seen by himself; one on the instep; the other in the sole of the foot; and a third case of the same disease in the latter situation; all of which were found to be incurable by the ligature of the anterior tibial artery. (P. 311.) He thinks, however, that the operation of tying this vessel where it passes over the dorsum of the foot, might succeed, if aided by compression, applied so as to stop the current through the other main channel; and he seems to approve of this practice, because the plan of tying the artery above and below the disease (which is the most certain means of cure) could not be done, without extensive incisions in the sole of the foot. In an aneurism at the lower part of the leg. Mr. Hodgson judiciously insists upon the prudence of tying the artery, as near as possible to the tumour, because the recurrent circulation, through the large inosculation in the foot, might still cause the swelling to enlarge, in consequence of the blood sent into the sac from the lower extremity of the vessel, passing through the aneurismal cavity into branches arising from the artery between the aneurism and the ligature. (P. 438.) In the same manner, when an aneurism arises from the ulnar, or interosseous arteries near the elbow, tying the brachial will suffice; but, if the disease be lower down, the vessel from which it proceeds must be taken up near the swelling. (*Op. cit.* p. 393.) Scarpa mentions a case, where the dorsal artery of the thumb was wounded; but, as the hemorrhage returned several times, and pressure failed in suppressing it, the surgeon took up

the radial artery at the wrist. After cutting off this direct current of blood towards the injured vessel, pressure on the wound proved effectual. Three months afterwards, the patient having died, the radial artery was found impervious for three fingers' breadth below where the ligature had been applied, and the dorsal artery was likewise obliterated from the root of the thumb to the beginning of the palmar arch.

The manner of exposing, and tying, the principal arteries of the leg and forearm will be described under the term *Arteries*.

OF ANEURISMS HIGH UP THE FEMORAL ARTERY.

Several facts, already specified in the preceding columns as having occurred many years before the operation of tying the external iliac artery was attempted, amounted to a full proof, that the circulation might go on in the lower extremity, notwithstanding the artery in the groin were tied, or obliterated. On this point, some of Guattani's cases were most decisive.

The ligature of the external iliac artery, for aneurisms of the femoral artery in the bend of the groin, has now been practised so frequently, and the instances of success are so numerous, that all doubt concerning the propriety and utility of the attempt has entirely ceased. The French, who have evinced great backwardness in espousing the Hunterian method of operating for aneurisms, though it be decidedly one of the greatest improvements in modern surgery, have also shown great reluctance even to believe, much less to practise, the operation of tying the iliac artery. A Parisian surgeon, however, who was recently in London, saw the thing done, and his brethren in the capital of France now begin to have their eyes a little more open. Still, as Roux remarks, "We cannot but blame the indifference, with which the operation is mentioned in some of the latest French surgical publications. At this moment, (1815,) we can reckon twenty-three facts, relative to tying the external artery; and, on fifteen of the patients, it has perfectly succeeded. In these twenty-three operations, I comprehend the two which were done in France; one at Brest, by Delaporte, and the other at Lyons, by Bouchet; cases, of the authenticity of which we cannot doubt. In the number of successful cases, is to be comprised Bouchet's operation, since the patient lived more than a year afterwards, and then died of the consequences of an inguinal aneurism of the opposite side. Of the other twenty-one operations, fifteen have been performed in London only, in the several hospitals of this metropolis, by Abernethy, Ramsden, A. Cooper, Brodie, and Lawrence, gentlemen who would never publish forged cases.

"Mr. A. Cooper alone had tied the external iliac artery six times before my journey to London, and during my stay there, I saw him perform the operation

Once. Four of his patients were entirely well; one of the three others died, the thirteenth week after the operation, of the bursting of an aneurism of the aorta. At this period, the circulation in the limb had been re-established. I saw the limb, after it had been dissected, among Mr. Cooper's anatomical preparations. Large and beautiful anastomoses existed round the pelvis, between the dilated branches of the internal iliac and femoral arteries. With respect to the sixth patient, the leg mortified, and the thigh was amputated without success. The seventh died of an hemorrhage, which took place the fourteenth or fifteenth day after the operation. (*Parallele de la Chir. Angloise avec la Chir. Francoise*, p. 275—276.)

The many facts which have been already published, exemplifying the propriety of this operation, must be highly gratifying to Mr. Abernethy, by whose judgment it was first suggested, and by whose enterprising hand it was first practised.

Mr. Abernethy has been called upon in several cases to take up the external iliac artery, and they all proved, that the anastomosing vessels were fully capable of conveying blood enough into the limb below, and that a vessel even of this size could become permanently closed after being tied. Three of the operations done by this gentleman, I was an eyewitness of, and, it is therefore with confidence that I can speak of the ease and simplicity of the requisite measures for securing the external iliac artery. (See *Abernethy's Surg. and Physiol. Essays*; and *Surgical Observations*, 1804; *Edinb. Med. and Surg. Journal* for January, 1807.)

In Mr. Abernethy's first operation of this kind, performed in 1796, an incision, about three inches in length, was made through the integuments of the abdomen, in the direction of the artery, and thus the aponeurosis of the external oblique muscle was laid bare. This was next divided, from its connexion with Poupart's ligament, in the direction of the external wound, for the extent of about two inches. The margins of the internal oblique and transverse muscles being thus exposed, Mr. Abernethy introduced his fingers beneath them to protect the peritoneum, and then divided them. Next he pushed this membrane with its contents upwards and inwards, and took hold of the external iliac artery with his finger and thumb. It now only remained to pass a ligature round the artery, and tie it; but, this required caution, on account of the contiguity of the vein to the artery. These Mr. A. separated with his fingers, and introducing a ligature under the artery with a common surgical needle, tied it about an inch and a half above Poupart's ligament, (*Surg. Essays*.)

The following was the method, which Mr. Abernethy adopted, the second time of tying the external iliac artery.

An incision, three inches in length, was made through the integuments of the abdo-

men, beginning a little above Poupart's ligament, and extending upwards; it was more than half an inch on the outside of the upper part of the abdominal ring, to avoid the epigastric artery. The aponeurosis of the external oblique muscle being exposed, was next divided, in the direction of the external wound. The lower part of the internal oblique muscle was uncovered, and the finger being introduced below the inferior margin of it and of the transversalis muscle, they were divided with the crooked bistoury for about one inch and a half. Mr. Abernethy now introduced his finger beneath the bag of the peritoneum, and carried it upwards by the side of the psoas muscle, so as to touch the artery about two inches above Poupart's ligament. He took care to disturb the peritoneum as little as possible, detaching it to no greater extent than was requisite to admit his fingers to touch the vessel. The pulsations of the artery made it clearly distinguishable, but Mr. Abernethy could not put his finger round it with facility. In order to be able to do so, he was obliged to make a slight incision on each side of it. Mr. A. now drew the artery gently down, so as to see it behind the peritoneum. By means of an eye-probe, two ligatures were conveyed under the vessel; one of these was carried upwards as far as the artery had been detached, and the other downwards: they were firmly tied, and the vessel was divided in the interspace between them. (*Surg. Observ.* 1807.)

In a third instance of tying this vessel. Mr. Abernethy operated exactly as in the foregoing case, and with complete success, (*See Edinb. Surg. Journ.* Jan. 1807.)

Mr. Freer, of Birmingham, who may be said to claim the honour of having seconded Mr. Abernethy in this new practice, made an incision about one inch and a half from the spine of the ilium, beginning about an inch above it, and extending it downwards about three inches and a half, so as to form altogether an incision four inches and a half long, extending to the base of the tumour. The tendon of the external oblique being exposed, was carefully opened, and also the internal oblique, when the finger, being introduced between the peritoneum and transversalis, served as a director for the crooked bistoury, which divided the muscle. Avoiding all unnecessary disturbance, Mr. Freer separated the peritoneum with his finger, till he could feel the artery beating, which was so firmly bound down, that he could not get his finger under it without dividing its fascia. The vessel having been separated from the surrounding parts, a curved blunt needle, armed with a strong ligature, was put under it, and tied very tight, with the intention of dividing the internal coats of the vessel. The operation led to a perfect cure. (*Freer on Aneurism*, p. 83; 4to. 1807.)

Mr. Tomlinson, of the same town, was also an early performer of the operation; he applied only one ligature, and, of course,

left the artery undivided: the event was attended with perfect success.

The following is Mr. A. Cooper's mode of operating, as described by Mr. Hodgson. A semilunar incision is made "through the integuments, in the direction of the fibres of the aponeurosis of the external oblique muscle. One extremity of this incision will be situated near the spine of the ilium: the other will terminate a little above the inner margin of the abdominal ring. The aponeurosis of the external oblique muscle will be exposed, and is to be divided throughout the extent and in the direction of the external wound. The flap, which is thus formed, being raised, the spermatic cord will be seen passing under the margin of the internal oblique, and transverse muscles. The opening in the fascia, which lines the transverse muscle, through which the spermatic cord passes, is situated in the midspace between the anterior superior spine of the ilium, and the symphysis pubis. The epigastric artery runs precisely along the inner margin of this opening, beneath which the external iliac artery is situated. If the finger, therefore, be passed under the spermatic cord, through this opening in the fascia, it will come into immediate contact with the artery, which lies on the outside of the external iliac vein. The artery and vein are connected together by a dense cellular membrane, which must be separated to enable the operator to pass a ligature, by means of an aneurism needle, round the former." (*On Diseases of Arteries*, p. 421—422.)

The foregoing incision, the convexity of which is turned outward, and downward, extends from within and a little above the anterior superior spinous process of the ilium to above and a little within the middle part of Poupart's ligament.

Mr. Norman, of Bath, who has tried both modes of operating, found that proposed by Mr. A. Cooper, a more easy way of finding the external iliac artery, than the longitudinal incision practised by Mr. Abernethy. "The objection, (says Mr. Norman,) to Mr. Cooper's mode of operating in cases, where the tumour extends high up, is by no means well founded; for the lower part of the bag, of the peritoneum, lying on the edge of Poupart's ligament, must in every case be exposed and detached, in order to get at the artery, which lies behind the posterior part of that membrane, and this is most easily effected by an incision in the direction of Poupart's ligament; whilst two-thirds of the longitudinal incision are made on a part of the peritoneum, which lines the abdominal muscles, and the lower portion only of the incision, reaches that part of the membrane, which is to be separated. The consequences of this are, that the peritoneum is in much greater danger of being wounded, and that the probability of a hernia forming after the cure, is much increased by the extensive division of the oblique muscles." (*See Med. Chir. Tran. vol. 10, p. 101.*) As far as I am able to

judge, these remarks are well founded, and they coincide with some observations, which were made some years ago by Roux, who, while he inclined to Mr. Abernethy's method, saw the disadvantage of letting the direction of the wound in this instance correspond to the course of the artery. Hence, after many trials on the dead subject, he laid down the rule, that the beginning of the wound should never be further, than half an inch from, and a very little higher, than the anterior superior spine of the ilium, and that it should be carried very obliquely downwards, to the middle of Poupart's ligament. (*See Nouveaux Elements de Med. Op. T. 1, p. 147. &c.*)

In a case, operated upon by Mr. Kirby, a hernia followed, in the situation where the abdominal muscles had been divided. (*See Cases with Observations, p. 109, Soc. Lond. 1819.*)

Dr. Post in one case found the peritoneum so thickened and diseased, that he could not raise it from the subjacent parts, and he was obliged to make an opening in it. The protruding viscera were then pushed back, and, with a needle, a ligature was introduced under the artery, the peritoneum being also included in the ligature. Notwithstanding the disadvantageous method of operating, and the return of pulsation in the swelling, the patient had so far recovered in three months, as to have regained the use of the limb. (*See American Med. and Phil. Reg. vol. 4, p. 443.*)

In one remarkable case, Mr. Newbiggin, by tying the external iliac artery, cured both an inguinal and a popliteal aneurism together. (*See Edin. Med. & Surg. Journal, for Jan. 1816, p. 71, &c.*)

The many operations, which have now been done on the external iliac artery, have impressed me with a conviction, that in subjects under a certain age, there is no reason to fear, that the anastomoses will not generally suffice for the supply of the lower extremity. Out of twenty-five cases, I only know of three, in which the limb was attacked with gangrene. These three were patients of Mr. A. Cooper, Bouchet, of Lyons, and Mr. Collier. The proportion is not so much as one in eight. The three instances of gangrene were not all in the circumstances, which permitted the event to be imputed to the anastomoses not having had sufficient time to enlarge, though perhaps Mr. Collier's case was such. On the other hand, we are to notice, that Dr. Cole's patient was operated upon a few days after the wound, and yet the limb was duly supplied with blood, and did not become gangrenous. It appears therefore to me, that the occasional occurrence of gangrene cannot be admitted as a just reason for delay, until the collateral vessels have had time to enlarge. I believe, that in all aneurismal diseases, early operating is the best, and most judicious practice. This was one principal cause, as Kirkland observes, which occasioned the bad success of the old surgeons in the treatment of pop-

lital aneurisms, and he foretold many years ago, that operations for the cure of aneurisms would answer better, if not deferred so long as formerly. (See *Thoughts on Amputation, &c. Seco. Lond. 1780.*) I join Kirkland in this sentiment, not without recollecting, that all aneurisms are attended with a chance of getting spontaneously well in the course of time. I saw the inguinal aneurism which did so, under Mr. Albert, in the York hospital; but as this also is a rare incident, I do not believe, that it ought to influence us against having speedy recourse to an operation. Besides, the cure by inflammation and sloughing, appears to me to be attended in reality with more peril, than a well-executed operation, and consequently, has less recommendations, than many may imagine. Had not Mr. Albert's patient been a very strong man, he would certainly have fallen a victim to the extensive disease, which the bursting and sloughing of the tumour created. Thus, Delaporte's patient died of the mass of disease, which the tumour itself made; for it had been suffered to attain too large a size, so that when it inflamed, the effects were fatal. (See *Richerand, Nosog. Chir. T. 4, p. 113, edit. 4.*)

I believe Dr. Wilmot's observation is perfectly correct, that, if a comparison were made between the operation of tying the external iliac artery and that of tying the artery in the thigh, we should find the recoveries after the first more frequent, in proportion to the number of times it has been done, than after common operations lower down. (See *Dublin Hospital Rep. &c. vol. 2, p. 214.*)

I subjoin a list of some of the successful examples of this operation. Mr. Abernethy, two cases, (*Surgical Works, vol. 1.*) Freer and Tomlinson, 2, (*Freer on Aneurism, 1807.*) Mr. A. Cooper, 4, (*Hodgson on Diseases of Arteries, p. 417.*) Goodlad, 1, (*Edin. Med. & Sur. Journ. vol. 8. p. 32.*) Mr. Brodie, 1, (*Hodgson, op. cit. p. 419.*) Lawrence, 1, (*Med. Chir. Trans. vol. 6. p. 205.*) J. S. Soden, 1, (*Same work, vol. 7. p. 536.*) G. Norman, 1, (*Same work, vol. 10. p. 95, &c.*) Bouchet, 1, (*Roux Med. Opératoire, T. 1. p. 744.*) J. S. Dorsey, (*Elements of Surgery, vol. 2, p. 180, Philadelphia, 1813.*) Mouland, 1, (*Bulletins de la Faculté de Médecine de Paris, T. 5. p. 535.*) Dupuytren, 1, (*French Transl. of Mr. Hodgson's Work, T. 2. p. 125.*) Dr. Cole, 1, (*Rapport des Travaux de la Société d'Emulation de la Ville de Cambrai, 1817, or Lond. Med. Repository.*) Dr. Wilmot, 1, (*Dublin Hospital Reports, vol. 2. p. 208, &c.*) Kirby, 1, (*Cases with Observations, &c. Seco. Lond. 1819.*) Dr. Post, 1, (*American Med. & Philos. Register, vol. 4.*) Newbiggin, (*Edin. Med. & Surg. Journ. January, 1816.*)

Some particulars of the case of ruptured inguinal aneurism, in which Mr. A. Cooper tied the aorta, will be hereafter noticed. (See *Aorta.*)

Rosenmuller's *Chir. Anat. Plates*, in illustration of the operation of tying the external

iliac artery, merit notice. (See *part 3, tab. 2, 7, and 9.*)

CASES OF GLUTÆAL ANEURISM CURED BY TYING THE INTERNAL ILIAC ARTERY.

The glutæal artery is large; from its situation, liable to wounds; from its size, subject to aneurism. Dr. Jeffray, of Glasgow, was consulted in a case, where the glutæal artery had been wounded. He urged the propriety of tying the vessel where it had been injured. This sensible advice was at first rejected, and when the friends at last consented, the operation was too late, as while preparation was making for it, the tumour burst, and the patient expired in a few moments.

Theden also mentions an instance, in which the glutæal artery was wounded in the dilatation of a gunshot wound, and the patient lost his life. (See *Scarpa on Aneurism, p. 407, Ed. 2.*)

Mr. John Bell, however, tied the glutæal artery in a case where it was wounded, and the patient was saved.

Mr. Stevens, surgeon in Santa Cruz, the gentleman who has proved the practicableness of putting a ligature round the internal iliac artery, informs us, that "one of the first surgeons in London had a patient with glutæal aneurism. The tumour was large; allowed to burst; and the person bled to death."

"I sincerely trust, says he, that the following case may be the means of preventing such an occurrence in future."

"Maila, a negro-woman, from the Bambara country in Africa, was imported as a slave into the West Indies in the year 1790. She was purchased for the estate Enfield Green; now the property of the heirs of P. Ferrall, Esq. I saw her first in the beginning of December, 1812. She had a tumour on the left hip, over the sciatic notch. It was nearly as large as a child's head, and pulsating very strongly. She could assign no cause for the disease. It had commenced about nine months before, with slight pain in the part; and had gradually increased to its present size. She was now much reduced, in great misery, and ready to submit to any operation." (See *Medico-Chir. Trans. Vol. 5. p. 425.*)

After a few more particulars, Mr. Stevens notices, that he had tied the internal iliac on the dead body, and that he believed it might be done with safety on the living.

The following is some account of this operation, as practised upon the above negro-woman.

"On the 27th December, 1812, (says Mr. Stevens,) I tied the artery in the presence of Dr. Lang, Dr. Van Brackle, Mr. Nelthropp, and Mr. Ford, the manager of the estate."

"An incision, about five inches in length, was made on the left side, in the lower and lateral part of the abdomen, parallel with the epigastric artery, and nearly half an

inch on the outer side of it. The skin, the superficial fascia, and the three thin abdominal muscles, were successively divided; the peritoneum was separated from its loose connexion with the iliacus internus and psoas magnus; it was then turned almost directly inwards, in a direction, from the anterior superior spinous process of the ilium, to the division of the common iliac artery. In the cavity, which I had now made, I felt for the internal iliac, insinuated the point of my fore-finger behind it, and then pressed the artery betwixt my finger and thumb. Dr. Lang now felt the aneurism behind; the pulsation had entirely ceased, and the tumour was disappearing. I examined the vessel in the pelvis; it was healthy and free from its neighbouring connexions. I then passed a ligature behind the artery, and tied it about half an inch from its origin. The tumour disappeared almost immediately after the operation, and the wound healed kindly. About the end of the third week the ligature came away, and in six weeks the woman was perfectly well."

This is the first example, in which the internal iliac has been tied. The operation was not attended with much difficulty, nor pain, and not an ounce of blood was lost.

Mr. Stevens had no difficulty in avoiding the ureter, which, when the peritoneum was turned inwards, followed it. Had it remained over the artery, Mr. Stevens says, that he could easily have turned it aside with his finger. (See a particular history of this case in *Medico-Chirurg. Trans. Vol. 5, p. 422, &c.*)

A second instance, in which the internal iliac artery was tied, was some time ago communicated to the public. The operation was performed by Mr. Atkinson, of York, on account of a glutæal aneurism. The following are a few of the particulars, as related by this gentleman: Thomas Cost, aged 29, presented himself at the York County Hospital, April 29th, 1817. He was a tall, strong, active bargeman, not corpulent, but very muscular. He was enduring great pain from a large renitent, pulsating tumour, situated under the glutæus of the right side; an obvious aneurism. It had existed about nine months, and was the consequence of a blow from a stone. In a consultation with Dr. Lanson and Dr. Wake, the necessity of the operation was determined upon, and it was performed on the 12th of May, without any material difficulty, or interruption, except such as was the consequence of the division of, and bleeding from, the small muscular arteries. Having got command of the internal iliac artery within the pelvis, (which, says Mr. Atkinson, required the complete length of the fingers to accomplish,) it was tied. Sufficient proof of its being the identical artery was repeatedly obtained, by the pressure upon it stopping the pulsation, and causing a subsidence of the tumour. Dr. Wake, Mr. Ward, and all the pupils, were quite assured of the circumstance. The artery being then tied,

the pulsation of the swelling entirely ceased. Some delay in placing the ligature arose from the needle not being sufficiently pliable; but, for future operations of this kind, Mr. Atkinson very properly recommends the ligature to be put round the artery by means of an instrument, resembling a catheter, the wire of which has a little ring at its extremity, and can be pushed out some way beyond the end of the tube.

The patient went on tolerably well for some time after the operation; the pulse never exceeded 130, and after a time sunk to 85 or 90. He became exhausted, however, partly by the discharge, and partly by hemorrhage, and died on the 31st of May, about nineteen days after the operation. In the dissection, the cavity, on the external part of the peritoneum, in the situation of the incision, was completely filled with coagulated blood. "The ligature, on moving a part of this (blood) with a sponge, readily followed it, and, without doubt, had been disengaged for some days." The internal iliac, which appeared to have been tied, had separated about an inch and a half from the bifurcation with the external iliac. By "separated" I conclude Mr. Atkinson means that the upper part of the internal iliac was separated from the continuation of the same vessel. (See *Medical and Phys. Jour. vol. 38, p. 267, &c.*) Although this gentleman has not given a very clear account of some part of the dissection, and he has also omitted to describe the place of his external incision, or the exact parts, which he divided in the operation, yet, I think that all the circumstances of the case taken together, leave not the smallest doubt, of the internal iliac artery having been actually tied. The complete stoppage of the pulsation, as soon as the ligature was applied, and the testimony of several respectable practitioners, who were present, seem, indeed, to remove all ambiguity. The profession, I think, are much indebted to Mr. Atkinson for this important communication, which was in some measure, required, in order to confirm Mr. Stevens's similar case, as, it is well known, that some distinguished anatomists and surgeons in this metropolis have expressed very strong doubts of the practicable nature of the operation.

In a modern publication are given a few particulars of a case, which was supposed to be an aneurism of the glutæal artery, and cured by means of pressure, a light vegetable diet, gentle laxatives, and digitalis. (See *Trans. of the Fellows, &c. of the King's and Queen's College of Physicians in Ireland, vol. 1, p. 41, 8vo. Dub. 1817.*) From the very imperfect account here given of the tumour, it is impossible to form any conclusion, respecting its nature.

Sandifort has recorded an instance of an aneurism of the internal iliac artery itself. (See *Tabule Anatomicae, &c. Præedit Observ. de Aneurysmate Arteriæ Iliacæ internæ, rariore ischiadicæ Nervosæ causa. fol. Lugd. 1804.*)

ANEURISMS OF THE BRACHIAL ARTERY.

Surgical writings contain many histories of aneurisms in the bend of the arm, produced by the puncture of the brachial artery in venesection, or caused by a deep wound inflicted at the bend of the arm, along the inner side of the humerus, or in the axilla. Such cases must indisputably be formed by effusion. Although Morand, &c. have found, that, along with aneurisms, caused by a wound of the brachial artery, the diameter of the vessel is sometimes unusually enlarged through its whole length, above the seat of the tumour, this enlargement, which is very rare, might have existed naturally, before the puncture occurred. Even were it frequent, such an equable longitudinal expansion of the tube of the artery could not explain the formation of the aneurismal sac in the bend of the arm, along the inner side of the humerus, or in the axilla, after wounds. (*Scarpa, p. 160.*)

The proximate cause of these cases may invariably be traced to the solution of continuity in the two proper coats of the artery, and the consequent effusion of blood into the cellular substance. The effect is the same, whether from an internal morbid affection, capable of ulcerating the internal and fibrous coats of the artery, the blood be effused in the neighbouring cellular sheath surrounding the artery, which it raises after the manner of an aneurismal sac; or, the wound of the integuments having closed, the blood issue from the artery, and be diffused in the surrounding parts. The cellular substance, on the outside of the wounded vessel, is first injected, as in ecchymosis; the blood then distends it, and elevates it in the form of a tumour, and, the cellular being destroyed, converts it at last into a firm capsule, or aneurismal sac. (*Scarpa, p. 367.*)

The circumscribed or the diffused nature of the aneurism, and the rapidity or slowness of its formation, depend on the greater or less resistance to the impetus of the blood, during the time of its effusion, by the interstices of the cellular substance surrounding the artery, and by the ligamentous fasciæ and aponeuroses, lying over the sac. The aponeurosis of the biceps muscle, being only half an inch broad, and situated lower than the common place for bleeding, cannot, at least in most cases, materially strengthen the cellular substance surrounding the artery, as is commonly supposed (*Scarpa, p. 168—170.*) This author refers the greatest resistance to the intermuscular ligament, which after having covered the body of the biceps muscle, extends over the whole course of the humeral artery, and is implanted into the internal condyle. This ligamentous expansion has a triangular shape, the base of which extends from the tendon of the biceps, to the internal condyle, while the apex reaches upward along the inner side of the humerus towards the axilla, in the course of the artery. The humeral artery and median nerve, kept in their si-

tuation by the cellular sheath and this ligamentous expansion, run in the furrow, formed between it and the internal margin of the biceps. (*Scarpa, 171.*) This author anatomically explains many circumstances relative to the diffusion, circumscription, shape, &c. of brachial aneurisms, from this intermuscular ligament. While aneurisms, from an internal cause, are not unfrequent in the aorta, thigh, and ham, they are very rare in the brachial artery; though a few such instances are recorded. (*Scarpa, 174, Pelletan's Clinique Chir. T. 2, p. 4.*)

The mode of distinguishing a wound of the brachial artery, in attempting to bleed, and the method of trying to effect a cure by pressure, are described in the article *Hæmorrhage*.

Anel was the first, who tied the brachial artery, for the cure of the aneurism at the bend of the arm, in the same way that Hunter did the femoral, for the cure of aneurisms in the ham, viz. with one ligature above the tumour, without making any incision upon, or into, the sac itself.

The operation is performed as follows:—the surgeon having traced the course of the brachial artery, and felt its pulsations above the aneurism, he may either cut down to the vessel immediately above the tumour, or much higher in the long space between the origins of the superior and inferior collateral arteries. The integuments are to be divided in the course of the artery, and also the cellular sheath, for the space of about two inches and a half. The surgeon now introducing his left fore-finger to the bottom of the wound, will feel the denuded vessel, and, if it is not sufficiently bare, he must divide the parts which still cover it, observing to introduce the edge of the knife, on the side next to the internal margin of the biceps, to avoid dividing any of the numerous muscular branches, which go off from the opposite side of the artery. He is then to insulate, with the point of his finger, the trunk of the vessel, alone if he can, or together with the median nerve and vein, and raise it a little from the bottom of the wound. He is to separate the median nerve and vein, for a small space from the artery, and with an eyed needle is to pass a ligature under the latter, and then tie it with a simple knot.

In the operation, it should always be recollected, that the median nerve lies on the inside of the artery, and, therefore, that the instrument, used for putting the ligature under the vessel, should be passed from within outwards, by which means the inclusion of the nerve may be most easily avoided. (*Boyer, Traité des Maladies Chirurgicales, &c. T. 2, p. 193.*)

The operation is well described by Mr. Hodgson: "The surgeon divides the integuments along the ulnar margin of the biceps muscle, by an incision two inches and a half in length. The thin fascia, which surrounds the arm, will thus be exposed, and must be cautiously divided in the direction of the external wound. The artery lies immedi-

ately under the fascia, close to the margin of the biceps. The median nerve is situated on the ulnar side of the artery, which lies between its two venæ comites. The internal cutaneous nerve is also situated under the fascia in the middle of the arm, and lies on the ulnar edge of the median nerve. The cellular membrane, which connects these parts, is to be divided, until the coats of the artery are fairly exposed. This part of the operation will be effected with facility, if an assistant compress the artery above the wound, so as to stop the circulation through it, and render it in some degree flaccid. The point of an aneurismal needle is then to be introduced close to the ulnar, and brought out on the radial side of the artery, so as to avoid including the median nerve, or the veins which accompany the artery." (See *Hodgson's Treatise on Diseases of the Arteries, &c.* p. 391.)

Whoever, after the above directions, says Scarpa, shall have the treatment of a *circumscribed* aneurism in the bend of the arm, will no longer, it is to be hoped, follow the method of those, who, supposing the tumour to be formed by the dilatation of the artery, used first to divide the integuments over the tumour, insulated the sac, and sought for the vessel above and below the aneurism, in order to tie it in two places; and then endeavoured to make the sac slough away. The operation is now reduced to the greatest simplicity, viz. tying the artery merely above the tumour. (See *Scarpa, p. 358, 359.*)

When the aneurism is *diffused*, and accompanied with violent inflammation and swelling of the whole arm, from the excessive distention of the clots of effused blood, Scarpa recommends the old operation of opening the tumour, and tying the artery at the bottom of the sac, above and below the wound made by the lancet. In this method, a tourniquet must be applied to the upper part of the arm, near the axilla; or, if the limb be very painful and swelled, it is better to let an assistant compress the artery from above the clavicle, against the first rib. The incision having been made into the tumour, and the blood discharged, a probe is to be introduced into the puncture in the vessel, from below upwards, so as to raise the artery. This, being separated from the parts beneath, and the median nerve, for a small extent, is to have two ligatures put under it, one of which is to be tied above, the other below, the wound in the vessel. Then the tourniquet, or pressure, is to be taken off, and if there be no bleeding, the wound is to be brought together. (See *Scarpa, p. 359.*) In reference to this operation, Rosenmüller's *Chir. Anat. Plates, Part 2. Tab. II.* and Camper's *Demonstr. Anat. Pathol. Lib. 1.* are worth consulting.

It was on the brachial artery, that Mr. Lambert, (*Med. Ob. & Inquiries, Vol. 2.*) made the experiment of closing the puncture in the vessel by means of the twisted suture, under an idea, that the plan would not, like compression, obliterate the arte-

rial tube, and therefore, that the risk of gangrene would be lessened. Now, although in the trial which was made, the bleeding was permanently stopped, Lambert was mistaken in supposing, that the pervious state of the wounded part of the artery, was preserved by the adoption of the twisted suture, instead of pressure or the ligature. If ever a small puncture in an artery heal, so as to leave the tube of the vessel pervious, it is under the circumstances pointed out by Dr. Jones. (See *Hemorrhage.*) Had Lambert had an opportunity of examining the state of the vessel, some time after the above operation, he would have found its canal obliterated; and had he known the freedom with which the collateral arteries anastomose with the recurrent arteries of the forearm, he would have known how to explain more correctly the re-establishment of the pulse. I need merely add, that as the false idea of preserving the perviousness of the artery was the only foundation for the method, the practice ought never to be revived, as not affording equal security from hemorrhage to what is obtained by the ligature, or even compression.

AXILLARY ANEURISMS.

Aneurisms occasionally take place in the axilla, and make it necessary to tie the subclavian artery. A question, here naturally presenting itself, is, whether the surgeon should attempt the operation in an early period of the disease, or wait till circumstances are urgent; the aneurism large and far advanced; the arm cedematous and insupportably painful; and the tumour in danger of bursting? In all cases of aneurism, unquestionably, there is a certain chance of the disease getting spontaneously well; and one axillary aneurism, in a man in St. Bartholomew's hospital a few years ago, had certainly disappeared of itself, as was proved by the account which the patient while living gave of his case, and by the obliteration of the artery, found on inspection after death.

I believe, however, we ought not to suffer our conduct to be too much influenced by the hope of so unfrequent an event, and, from the observations, which I have made on this subject, it is my decided opinion, that the operation should never be delayed, so as to allow the tumour to acquire an immoderate size. The operation is always difficult; but, the difficulty is seriously increased, when the swelling has extended far towards the breast, and has become so large as to push the clavicle considerably upwards. The several examples, in which the subclavian artery has now been tied, have furnished abundant proof, that the anastomoses are fully competent to the supply of the limb with blood. The plan, therefore, of delaying the operation long, with the view of allowing the inosculating arteries to enlarge, must be as questionable here, as in some other cases of aneurism, and at

all events, the maxim may be safely advanced, that, previously to the operation, the tumour should never be suffered to acquire an enormous size.

That the limb would receive an adequate supply of blood was well proved, even without the performance of the operation, by cases in which the axillary and subclavian arteries had been rendered impervious by disease, as, for instance, by the pressure of an aneurism of the aorta. (For an account of such facts, the reader is particularly referred to *Hodgson's Treatise on the Diseases of Arteries*, p. 111; *Journal de Médecine by Corvisart, Leroux and Boyer*, T. 2, p. 29; *Corvisart, Essai sur les Maladies du Cœur*, p. 215.)

"In these cases (says Mr. Hodgson) the only unusual circumstances, which was observed during the life of the patients, was the deficiency of the pulse at the wrist. The limbs were well nourished, although a considerable extent of the main artery (the subclavian) was obliterated, even before it had given off any branches." (P. 47.)

This vessel was tied by a Mr. Hall in Cheshire, when it had been wounded with a scythe, and its ends exposed; the arm was preserved, though it remained somewhat weakened, which might be owing to the division of some large nerve. (See *J. Bell, on Wounds*, p. 60, edit. 3, and *Scarpa*, p. 372.) Mr. White, of Manchester, relates another instance of this vessel being tied, in the case of a wound; but, mortification of the limb and death followed. Three of the nerves were found included in the ligature. (*London Med. Journ.* V. 4.) In cases of wounds of the axillary, or any other large arteries of the extremities, the surgeon, before proceeding to apply a ligature, should first ascertain the precise place of the wound in the artery; and, for this purpose, it may sometimes be proper, in certain wounds of the shoulder, to make an incision in the axilla so as expose the injured part of the vessel; or, if circumstances do not forbid it, the external wound may be dilated, until the exact part where the artery has been wounded is discovered. In proof of the propriety of acting in this manner, and applying a ligature above and below the wound in the vessel, Scarpa quotes a case, in which such practice was successful on a patient under M. Maunoir, of Geneva: the artery had been injured with a sabre near the head of the humerus: but, after the wounded part of the vessel had been traced, and secured in the way above suggested, the patient, a boy fourteen years of age, was saved from the dangers of hemorrhage and recovered the use of his arm, as fast as this was possible, with the loss of the first phalanges of the three last fingers from gangrene. (See *Scarpa on Aneurism*, p. 412, Ed. 2, and *Journ. de Méd.* T. 40, Mars 1811.)

There are two modes of operating for axillary aneurisms; one by cutting below the clavicle, in order to take up the axillary artery itself; the other, by making the

wound above the bone, for the purpose of securing the subclavian artery at the point where it emerges from behind the anterior scalenus muscle.

The first of these methods has been attempted by Desault, Pelletan, Mr. Keate, Mr. Chamberlaine, &c. It was in a case of wound of the axillary artery, that Desault operated. An incision, six inches long, was made below the external third of the clavicle; two thoracic arteries cut were immediately tied; the two lower thirds of the great pectoral muscle were next divided with a bistoury guided on a director: a large quantity of coagulated blood was now discharged; and the artery was directly taken hold of, and tied, together with the brachial plexus of the nerves. The arm mortified, and the patient died. This case, we must agree with Scarpa, was not a fair trial of the operation, inasmuch as the inclusion of the plexus of nerves in the ligature was an improper measure, and must have promoted the occurrence of sphacelus. It seems also probable from the account, that the vein was likewise tied; another serious and objectionable proceeding. Besides, it is worthy of notice, that the case was a wound of the axillary artery, attended with a copious effusion of blood in the cellular membrane. In all examples of this kind, gangrene is more readily induced, than when the case is a mere circumscribed aneurismal tumour. (See *Œuvres Chir. de Desault par Bichat*, Tome 2, p. 553.) As for Pelletan's example, it hardly deserves recital, because the operation in fact was not achieved. His colleagues objected to dividing the pectoral muscle; a random thrust was made with a needle and ligature; but, the artery was not included, and the experiment was not repeated. (See *Clinique Chirurgicale*, Tom. 2, Obs. 7, p. 49.)

In a case of axillary aneurism, which had actually burst, and the hemorrhage from which could only be stopped by pressing the artery against the first rib, Mr. Keate, the surgeon-general, practised the following operation, which was attended with completely successful consequences. This gentleman determined on taking up the artery, above the diseased and ruptured part, in its passage over the first rib. Accordingly, he made an incision obliquely downwards, divided the fibres of the pectoral muscle, that were in his way, and, when he came to the artery, passed a curved, blunt-pointed, silver needle, armed double, as he conceived under the artery, and tied two of the ends. After a careful examination, finding that the artery pulsed below the ligature, he determined on passing another ligature higher up, and nearer to the clavicle: he, therefore, passed the needle more deeply, so as evidently to include the artery. In a few days the swelling of the arm began to subside, the wound suppurated, and the ligatures came away with the dressings. The arm afterwards recovered its feeling, and the patient regained, in a great measure,

the entire motion of the shoulder, &c. (See *Med. Review and Magazine for 1801.*)

Mr. Keate's operation is objectionable, inasmuch as it was a dive made with a needle, and attended with great danger of wounding and tying parts which should be left undisturbed.

Mr. R. Chamberlaine, of Kingston, Jamaica, took up the axillary artery below the clavicle, in a patient, who had an aneurism in the left axilla, occasioned by a wound with a cutlass on the fifth of October, 1814. On the 10th of January, the tumour had considerably increased, and was less compressible than it had been when first seen by Mr. Chamberlaine. The operation was done on the 17th of January, 1815: "a transverse incision, of three inches in length, was made through the skin and platysma myoides, along and upon the lower edge of the clavicle, three fingers' breadth from the sternal end of that bone, and terminating about an inch from the acromion scapulae. This incision divided a small artery, which was immediately secured. A second incision, of three inches in length, was also made obliquely through the integuments over the deltoid and pectoral muscles, meeting the first nearly in the centre. The cellular membrane and fat, lying between them at the upper part, were now removed. The next step consisted in detaching the clavicular portion of the pectoralis major, and taking away the fat and cellular membrane lying over the subclavian vessels. The artery was now brought into view, and its pulsations made it clearly distinguishable from the contiguous parts." After several ineffectual efforts, Mr. Chamberlaine succeeded in conveying a ligature under it, by means of an eye-probe, curved for the purpose, and the point of which was brought up with the aid of a pair of forceps. On the 22d of February, the wound was completely healed; the aneurismal tumour reduced to the size of a turkey's egg, and very solid; the arm smaller than its fellow, but its muscular power improving. (See *Medico-Chir. Trans. Vol. 6, p. 128, &c.*) Mr. Chamberlaine expresses his conviction, that the operation would have been much facilitated, had he been furnished with the instruments described in Mr. Ramsden's work for passing the ligature under the artery.

The subclavian artery might be got at below the clavicle, as follows: the surgeon is to make an incision, through the integuments, about an inch from the sternal end of this bone. The cut is to run in the direction towards the acromion, deviating a little downward from a line parallel to that of the clavicle. This wound will bring into view some fibres of the great pectoral muscle originating from the last-mentioned bone. These are next to be divided. Some cellular substance will be found underneath, which is to be carefully raised with a pair of dissecting forceps, and cut. The operator will thus arrive at the great subclavian vein, and cephalic vein uniting with

it. Under the subclavian vein, and a little further backward, more under the clavicle, the subclavian artery may be felt and tied. (See *C. Bell's Operative Surgery, Vol. 2. p. 370.*)

On the whole, however, I think, Mr. Hodgson's directions for the performance of this operation, are the best which have been given. A semilunar incision through the integuments, which is to have its convexity downwards, and to begin about an inch from the sternal end of the clavicle, being continued towards the acromion for the extent of three or four inches, so as to end near the anterior margin of the deltoid muscle, without reaching into the space between the deltoid and pectoral muscle, in order to avoid wounding the cephalic vein. This incision will expose the fibres of the pectoral muscle, which are now to be divided in the direction and extent of the external wound. The flap is then to be raised, by dividing the loose cellular membrane, which connects the pectoral muscle to the parts underneath it. The pectoralis minor will now be seen crossing the inferior part of the wound; and by introducing his finger between the upper edge of this muscle and the clavicle, the surgeon may feel the pulsations of the axillary artery. Here one of the cervical nerves lies above, but in contact with the artery; the other nerves are behind it. In the dead subject, the axillary vein is situated below it; but, in the living, the vein is distended, and conceals the artery. The cellular membrane, connecting these parts, is to be separated by careful dissection, or by lacerating it with a blunt instrument. A ligature having been drawn under the artery with an aneurism-needle, the ends of the cord are to be raised, and a finger passed down, so as to compress the part surrounded by the ligature. If the artery be included, the pulsation in the aneurism will immediately cease. This precaution is highly necessary, lest one of the cervical nerves should be tied, instead of the artery. (See *Hodgson on Diseases of Arteries, &c. p. 362.*)

When an aneurism extends a certain way inwards, or towards the trachea, the operation below the clavicle becomes impracticable, and it is now requisite to make the incision above that bone, and take up the subclavian artery at the point, where it comes out from between the scaleni muscles, and lies on the flat surface of the first rib.

In the dead subject, without any tumour under the clavicle, this operation is easy enough; but in a living patient, the difficulty is much increased, by a large axillary aneurism, for then the clavicle becomes so much elevated, and the artery lies so deeply below it, that the vessel can hardly have a ligature carried under it, without a particular needle for the purpose. This was the case in an attempt which I once saw made to tie the artery, and in which one of the cervical nerves, affected by the pulsation of the artery, was mistaken for it, and tied, so

that the aneurism soon afterwards burst, and a fatal hemorrhage arose. Hence, the advice given by my friend Mr. Hodgson always to operate in this case while the tumour is small, cannot be too well remembered. The chief difficulty in the operation is that of passing the ligature under the artery; but, it may be done with the aid of an ingenious needle, which Mr. Ramsden has described, and which is exactly similar in principle to Desault's *aiguille à ressort*.

In order to avoid the inconveniences of the needles ordinarily used for conveying ligatures under deep arteries, Desault (says Bichat) invented "une aiguille à ressort," composed of a silver tube, or sheath, which was strait at one end, and bent at the other in a semicircular form. This sheath enclosed an elastic wire, the projecting extremity of which was accurately fitted to the end of the sheath, and perforated with a transverse eye. The instrument was passed under the artery, and, as soon as it had reached the other side of the vessel, the sheath was kept fixed, while an assistant pushed the elastic wire, which, rising from the bottom of the wound, presented the aperture or eye to the surgeon, who now passed the ligature through this opening. The wire was next drawn back into its sheath again, and the whole instrument brought from beneath the artery, by which means the ligature was conveyed under the vessel. (See *Œuvres Chir. de Desault, par Bichat, Tom. 2, p. 560.*)

The invention of this needle makes a material diminution in the difficulty of taking up the subclavian artery from above the clavicle; nor can it be wondered, that, without such an instrument, the operation should have baffled even so skilful a surgeon as Mr. A. Cooper. (See *Lond. Med. Review. Vol. 2, p. 200.*)

The following example is the first, in which the attempt to tie the subclavian artery by cutting above the clavicle, was ever accomplished.

John Townly, a tailor, aged thirty-two, addicted to excessive intoxication, of an unhealthy and peculiarly anxious countenance, was admitted into St. Bartholomew's Hospital on Tuesday the 2d of November, 1809, on account of an aneurism in the right axilla. The prominent part of the tumour in the axilla was about half as big as a large orange, and there was also much enlargement and distention underneath the pectoral muscle, so that the elbow could not be brought near the side of the body.

"The temperature of both arms," says Mr. Ramsden, "was alike, and the pulse in the radial artery of each of them was correspondent. After the patient had been put to bed, some blood taken from the left arm, and his bowels emptied, his pulse, which, on his admission, had been at 130, became less frequent; his countenance appeared more tranquil; and he experienced some remission of the distressing sensations in the affected arm: this relief, however, was of short duration; the weight and in-

cumbrance of his arm soon became more and more oppressive, and, in resistance to every medical assistance, his nights were again passed without sleep, and his countenance reassumed the anxiety which had characterized it when he first presented himself for advice."

On the sixth day after his admission, it was agreed, in consultation, that as the tumour (although increasing) did not appear immediately to endanger the life of the patient, from any probability of its bursting suddenly, it would be adviseable yet to postpone the operation, for the purpose of allowing the greatest possible time for the anastomosing vessels to become enlarged; and, in the meanwhile, that the case should be most vigilantly watched.

About this period of the case, the pulsation of the radial artery of the affected arm gradually became more obscure, and soon after either ceased, or was lost in the edema of the forearm and hand.

On the evening of the twelfth day, a dark spot appeared on the centre of the tumour, surrounded by inflammation, which threatened a more extensive destruction of the skin. A father postponement of the operation being deemed inadmissible, Mr. Ramsden performed it the next day in the following manner:

"A transverse incision was made through the skin and platysma myoides along, and upon the upper edge of the clavicle, about two inches and a half in length, beginning it nearest to the shoulder, and terminating its inner extremity at about half an inch within the outward edge of the sterno-cleido-mastoideus muscle. This incision divided a small superficial artery, which was directly secured. The skin, above the clavicle, being then pinched up, between my own thumb and finger, and those of an assistant, I divided it, from within, outwards and upwards, in the line of the outward edge of the sterno-cleido-mastoideus muscle, to the extent of two inches.

"My object, in pinching up the skin for the second incision, was to expose at once the superficial veins, and by dissecting them carefully from the cellular membrane, to place them out of my way, without wounding them. This provision proved to be useful, for it rendered the flow of blood during the operation very trifling, comparatively with what might otherwise have been expected; and thereby, enabled me with the greatest facility to bring into view those parts, which were to direct me to the artery.

"My assistant having now lowered the shoulder, for the purpose of placing the first incision above the clavicle, (which I had designedly made along and upon that bone) I continued the dissection with my scalpel, until I had distinctly brought into sight the edge of the anterior scalenus muscle, immediately below the angle, which is formed by the traversing belly of the omohyoides, and the edge of the sterno-cleido-mastoideus, and having placed my finger

on the artery, at the point where it presents itself between the scapuli, I found no difficulty in tracing it without touching any of the nerves to the lower edge of the upper rib, at which part, I detached it with my finger nail for the purpose of applying the ligature.

"Here, however, arose an embarrassment, which (although I was not unprepared for it) greatly exceeded my expectation. I had learned from repeatedly performing this operation, many years since, on the dead subject, that to pass the ligature under the subclavian artery, with the needle commonly used in aneurisms, would be impracticable; I had, therefore, provided myself with instruments of various forms and curvatures to meet the difficulty, each of which most readily conveyed the ligature underneath the artery; but, would serve me no farther; for, being made of solid materials, and fixed into handles, they would not allow of their points being brought up again at the very short curvature, which the narrowness of the space, between the rib and the clavicle, afforded, and which, in this particular case, was rendered of unusual depth, by the previous elevation of the shoulder by the tumour.

"After trying various means to overcome this difficulty, a probe of ductile metal was at length handed me, which I passed under the artery, and bringing up its point with a pair of small forceps, I succeeded in passing on the ligature, and then tied the subclavian artery at the part, where I had previously detached it for that purpose. The drawing of the knot was unattended with pain, the wound was closed by the dry suture, and the patient was then returned to his bed." (See *Practical Observations on the Sclerocele, &c. to which are added four cases of operations for Aneurisms*, p. 276, &c.)

It only seems necessary for me to add, that immediately, the artery was tied, the pulsation of the swelling ceased; that the arm of the same side continued to be freely supplied with blood, and was even rather warmer than the opposite arm; that the operation, which was severe from the length of time it took up, was after a time followed by considerable indisposition; that the patient died about five days after its performance; that, after the artery had been tied, the œdema of the arm, and the aneurismal tumour partly subsided; and, that on examination after death, nothing, but the vessel, was found included in the ligature.

In this publication are descriptions of instruments, which will be of great service to any future performer of this operation. The chief one is a needle, resembling that, which was invented and used by Desault, and of which I have already endeavoured to give an idea. By means of this instrument, I conceive, that the main difficulty of the operation will not in future be experienced. Had Mr. Ramsden had its assistance, his patient would have been detained a very little time in the operating theatre, and the

event of the case might have been completely successful. Having witnessed all the circumstances of the case, the inference, that I drew from them was, that, if the operation could have been done in a moderate time, which now seems practicable with the aid of the *aiguille à ressort*, the case in all probability would have ended well. The preceding case is particularly memorable, as being the first instance, in which the subclavian artery was scientifically tied, without any random thrust of a needle, and without the inclusion of any part besides the artery in the ligature. It furnished encouragement to repeat the experiment, held out the hope, that axillary aneurisms might be cured as well as inguinal ones; and confirmed the competency of the anastomosing arteries to nourish the whole upper extremity, when the subclavian is tied where it emerges from behind the anterior scalenus muscle.

In the year 1811 the subclavian artery was tied in the London Hospital, in a case of axillary aneurism, by Sir W. Blizard, who found no difficulty in getting the ligature under the artery, with a common aneurism needle. A single ligature was applied. At first, hopes of recovery were entertained; but the patient, who was old and debilitated, afterwards sunk, and died on the fourth day. (See *Hodgson's Treatise*, p. 375.)

In the year 1815, Mr. Thomas Blizard tied the subclavian artery, in the same hospital. The case was an aneurism in the left axilla, and, like all the other examples of this kind upon record, was attended with great pain in the tumour and limb. There was no pulse in the left radial artery, though there was scarcely any difference in the temperature of both arms. "An incision, about three inches in length, was made through the integuments at the root of the neck, on the acromial side, and parallel with the external jugular vein. The *platysma myodes* being divided, the cellular membrane was separated with the finger, until the pulsation of the subclavian artery was felt where the vessel passes over the first rib. The finger being pressed upon this part of the artery, the cellular sheath investing it was carefully opened with the point of a knife. A ligature was then conveyed underneath the artery, by a common aneurism-needle with the greatest facility." As soon as the ligature was tied, the pulsation in the tumour ceased. On the second day after the operation, the left arm began to have more feeling, and was as warm as the right. However, difficulty of breathing, twitchings, delirium, &c. afterwards ensued, and the patient died on the evening of the eighth day, previously to which event the ring and middle fingers turned black. On opening the body, the pericardium exhibited the effects of a high degree of inflammation, and the heart was covered with flakes of lymph, its posterior surface being of a deep red colour. The inner membrane of the ascending aorta was of a bright scarlet hue, was much diseased and studded

with white patches. A reddish appearance was also noticed in the lining of the right carotid, left subclavian, and even the abdominal aorta. The boundaries of the aneurismal tumour were in a state of sphacelation. These are all the circumstances which I wish here to notice; but more particulars may be perused in Mr. Hodgson's work, p. 602.

It is remarkable, that in the cases operated upon in the London Hospital, there was no difficulty experienced in passing the ligature under the artery with a common aneurism-needle, a circumstance which must have depended upon the space between the clavicle and the first rib having been less deep in these instances than the two which fell under my own observation, or in others which occurred in the practice of Dr. Colles and Mr. A. Cooper. (See *Lond. Med. Review*, vol. 2. p. 200, and *Edinb. Med. and Surg. Journ.* January, 1815.)

In Dr. Colles's first case, the artery was tied before it reached the scaleni muscles, as the tumour, which was in the right subclavian artery, extended from the sternal origin of the sterno-mastoid muscle along the clavicle, a little beyond the arch of that bone, and rose nearly two inches above it, in a conical form, the apex of the cone being situated at the outer edge of the foregoing muscle. After a tedious dissection, it was found, that only a quarter of an inch of the artery was sound, and on this portion the ligature was placed. Great difficulty was encountered in passing it round the artery, and the pleura was supposed to have been slightly wounded. Before tightening the ligature, the breathing became laborious, and the patient complained of oppression about the heart. These symptoms, indeed, were so violent, that it was judged prudent not immediately to tighten the ligature. On the fourth day, however, the artery was constricted, when the pulse at the wrist ceased, the patient not seeming to suffer much from what had been done. The patient then went on pretty well till the ninth day, when he was seized with a sense of strangling, and pain about his heart, and becoming delirious, died in nine hours after the beginning of this attack. On dissection, the aorta was found diseased, and the disease extending into the subclavian artery.

In another instance, Dr. Colles tied this vessel at the point, where it emerges from between the scaleni muscles, without any particular difficulty. The operation, however, was soon followed by a train of severe symptoms, delirium, and mortification, and the patient died on the fifth day. (See *Edinb. Med. and Surg. Journ.* January, 1815.)

The first case, in which complete success attended the operation of tying the subclavian artery, where it first comes from behind the anterior scalenus muscle, was that under the care of Dr. Post, of New-York. The patient was a gentleman, with an aneurism in the left axilla. Dr. Post performed the operation on the 8th of September, 1817,

in the following manner. "An incision, commencing at the outer edge of the tendon of the mastoid muscle, was carried through the integuments about three inches in length, in a direction deviating a little from a parallel line with the clavicle. This divided the external jugular vein, the bleeding of which required a ligature for its suppression; and, in proceeding with the operation, three or four arterial branches were cut, which it was also necessary to secure. The subclavian artery was then sought for immediately external to the scaleni muscles, and was easily laid bare. Passing over the artery at this place, in contact with it, were three considerable branches of nerves, running downwards towards the chest, from the plexus above. These were separated, and a ligature passed under the artery, with great facility, by the instrument well adapted to this purpose, invented by Drs. Parish, Hartshorne, and Hewson, of Philadelphia. On tying the ligature, all pulsation ceased in the limb." In the afternoon, the temperature of the limb was observed to be rather higher, than that of the other arm. On the 17th of September, the aneurismal tumour burst, and about three ounces of dark coagulated blood were discharged. On the 26th the ligature came away from the subclavian artery. Oct. 11, the wound was entirely healed, and on the 16th of the same month, the patient required no further attendance, his only complaints being now a little occasional pain in the fingers, and a superficial sinus at the part where the tumour burst. (See *Medico-Chir. Trans.* vol. 9. p. 186, &c.)

The instructions, delivered by Mr. Hodgson, for the performance of this operation, are the best with which I am acquainted. When the subclavian artery (says this gentleman) has emerged from behind the anterior scalenus muscle, it passes obliquely over the flat surface of the first rib, with which it is in immediate contact. The cervical nerves are situated above, and a little behind the artery: the subclavian vein passes before it, and underneath the clavicle. If the finger be passed down the acromial margin of the anterior scalenus muscle, the artery will be found in the angle, formed by the origin of that muscle from the first rib. The shoulder being drawn down as much as possible, the skin is to be divided, immediately above the clavicle, from the external margin of the clavicular portion of the mastoid muscle, to the margin of the clavicular insertion of the trapezius. No advantage whatever is gained by cutting the clavicular attachment of the sternocleido-mastoideus. The exposed fibres of the platysma myodes are now to be carefully divided, without wounding the external jugular vein, which lies immediately under them, near the middle of the incision, and should be detached, and drawn towards the shoulder with a blunt hook. The cellular membrane, in the middle of the incision, is then to be cut, or separated with the finger, until the surgeon arrives at the acro-

mial edge of the anterior scalenus. He passes his finger down the margin of this muscle, until he reaches the part where it arises from the first rib, and in the angle, formed by the origin of the muscle from the rib, he will feel the artery. The ligature is now to be conveyed under the vessel, with an aneurism-needle, or that recommended by Desault. (*Hodgson on the Diseases of Arteries, &c. p. 376, &c.*)

Breschet thinks, that the safest and easiest method is that adopted by Dupuytren, as follows: an incision, three or four inches long, is to be made at the lower and outer part of the neck, and extended to the clavicle. This first incision, situated behind the external edge of the sterno-mastoid muscle, should go through the skin, the cellular membrane, and platysma myoides. Some venous branches, running into the jugulars, will then be met with, which should be surrounded by a double ligature, and divided in the interspace. A director is then to be introduced under the omohyoideus muscle, in order to facilitate its division, and the surgeon will at length reach the external edge of the anterior scalenus. A curved probe-pointed bistoury is then to be gradually and cautiously passed behind that muscle, with the flat surface of the blade against it, and deeply enough to divide the external third, or half of the fibres of the same muscle, or even all of them, if requisite. The insulated artery will then be felt at the bottom of the wound, situated in the area of a triangle, the upper side of which is formed by the brachial plexus, the lower by the subclavian vein, and the inner by the scalenus. A ligature is then conveyed under the artery by means of the needle invented by Deschamps. (See *French Transl. of Mr. Hodgson's work, T. 2, p. 126.*) Whether cutting the anterior scalenus and omohyoideus will facilitate the operation is questionable; but the assertion, that these measures increase its safety, is what I cannot understand.

With respect to the mode of tying the subclavian artery on the tracheal side of the scalenus, we have seen that it was performed by Dr. Colles, and the event of the case was fatal. Descriptions of the operation may be found in Mr. Hodgson's work, p. 382. When I consider the manner in which the subclavian artery, before it passes behind the anterior scalenus, is surrounded by parts of great importance, I can scarcely bring my mind to think, that the measures, requisite for taking up the vessel in this situation, will ever leave the patient much chance of recovery. "Between the aorta and scaleni muscles (says Mr. A. Burns) the subclavian arteries are connected with several important vessels and nerves. They are in the vicinity of the nervus vagus, of the recurrent laryngeal nerve, of the sympathetic nerve, of the phrenic nerve, and the subclavian vein; and, on the left side, the subclavian artery is intimately connected with the termination of the thoracic duct. These parts are all grouped together

in a very narrow space, and the perplexity of their dissection is further increased by the interlacement of the different nerves with one another. The natural connexions of these parts are best shown by merely raising the sternal extremity of the sterno-mastoid muscle. If this be done, the nervus vagus will be brought into view, lying on the forepart of the subclavian artery, almost directly behind the sternal end of the clavicle; and exactly opposite to the nervus vagus, but behind the artery, the lower cervical ganglion of the sympathetic nerve will be brought into view. The recurrent nerve, on the right side, hooks round the subclavian artery, and, in its course towards the larynx, ascends along the tracheal side of the sympathetic nerve. On the left side, it twines round the arch of the aorta, and, in mounting upward, is interposed between the subclavian artery and oesophagus. The subclavian vein lies anterior to the artery, and, in the collapsed state, sinks nearer to the thorax;" but, when distended in the living body, it overlaps the artery. The thoracic duct enters the subclavian vein, about the eighth of an inch nearer to the acromion than the point, where the internal jugular vein empties itself into the subclavian vein. The termination of the thoracic duct is situated between the sternal and clavicular portions of the sterno-mastoid muscle. (*A. Burns, on the Surgical Anatomy of the Head and Neck, p. 28.*)

It has been proposed to tie the arteria innominata in cases of aneurism of the subclavian artery. From a variety of facts, specified by a late interesting writer, it seems probable, that the brain and arm would receive an adequate supply of blood, although the arteria innominata were obliterated. On the whole, however, I fully coincide with Mr. Hodgson in condemning the proposal. The chief objections to it arise from the difficulty of the operation in the living subject; from the inflammation likely to be thereby excited among the important neighbouring parts; from the danger of hemorrhage, in consequence of the adhesion of the vessel being likely to be broken by the force of the circulation; and, lastly, from the equal practicableness of tying the subclavian artery, in most cases, on the tracheal side of the scalenus. (See *Hodgson on Diseases of Arteries, p. 384.*)

A case, in which an axillary aneurism, unattended with pulsation, was punctured, and the child bled to death, is noticed in a modern periodical work. (See *Med. Chir. Journ. vol. 4. p. 73.*)

For anatomical views of the parts concerned in the operation of taking up the subclavian artery, consult *Rosenmuller's Chir. Anat. Plates, Part 2, Tab. 8 and 9.*

Some valuable anatomical remarks, in relation to the operation, are given by Mr. A. Burns. (*Surgical Anatomy of the Head and Neck, p. 28, &c.*)

CAROTID ANEURISMS.

There is no part of the body where the diagnosis of aneurisms is more liable to mistake, than in the neck. Here the disease is particularly apt to be confounded with tumours of another nature. We have already cited, in this article, examples in which aneurisms of the arch of the aorta so resembled those of the carotid, as to have deceived the surgeon who was consulted. The swelling of the lymphatic glands, or of the cellular substance which surrounds the carotid artery; the enlargement of the thyroid gland; and especially abscesses, may resemble an aneurism by the pulsations, communicated to them by the neighbouring artery. On the other hand, aneurisms of long standing, which no longer throb, and the integuments over which are changed in colour, and likely to burst, may the more easily be mistaken by an inattentive practitioner for chronic abscesses, as the neck is remarkably often the seat of such diseases. (*Boyer, Traité des Maladies Chirurgicales*, t. 2, p. 185.)

Scarpa mentions one unfortunate patient, who was killed by a knife being plunged in a carotid aneurism, on the supposition that the case was an abscess.

I need scarcely observe, that by opening a carotid aneurism, a surgeon would expose himself to the disgrace and mortification of seeing the patient die under his hands, as happened in the example cited by Harderus. (*Apiaar. Observationum*, Obs. 86.)

The possibility of tying the carotid artery, in cases of wounds and aneurisms, without any injurious effect on the functions of the brain, is now completely proved. Petit mentions, that the advocate Viellard, had an aneurism at the bifurcation of the right carotid, for the cure of which he was ordered a very spare diet, and directed to avoid all violent exercise. Three months after this prescription, the tumour had evidently diminished; and, at last, it was converted into a small, hard, oblong knot, without any pulsation. The patient having died of apoplexy, seven years afterwards, the right carotid was found closed up and obliterated, from its bifurcation, as low down as the right subclavian artery. (*Acad. des Sciences de Paris*, an. 1765.) Haller dissected a woman whose left carotid was impervious. (*Opuscula Pathol. Obs.* 19, Tab. 1.) An example of the total closure of both carotids, in consequence of ossification, is stated by Koberwein to be recorded by Jadelot. (*German Transl. of Mr. Hodgson's work*, p. 293.) Hebenstreit, vol. 4, p. 266. ed. 3. of his Translation of B. Bell's Surgery, mentions a case, in which the carotid artery was wounded, in the extirpation of a scirrhus tumour. The hemorrhage would have been fatal, had not the surgeon immediately tied the trunk of the vessel. The patient lived many years afterwards. This is probably the earliest authentic instance, in which a ligature was applied to the carotid artery. Mr. Abernethy's case is perhaps

the second; and that in which Mr. Fleming, a naval surgeon, tied the common carotid in a sailor, who attempted suicide, and who was saved by the operation, is still later, not having occurred till the year 1803. (*See Med. Chir. Journ.* vol. 3, p. 2.)

Dr. Baillie knew an instance, in which one carotid was entirely obstructed, and the diameter of the other considerably lessened, without any apparent ill effects on the brain. (*See Trans. of a Society for the Improvement of Med. and Chir. Knowledge*, vol. 1, p. 121.) Mr. A. Cooper has also recorded an example, in which the left carotid was obstructed by the pressure of an aneurism of the aorta; and yet, during life, no paralysis, nor impairment of the intellects had occurred. (*See Med. Chir. Trans.* vol. 1, p. 223.) A similar case is related by Pelletan. (*Clinique Chir.* t. 1, p. 68.)

Mr. Abernethy was under the necessity of tying the trunk of the carotid, in the case of a large lacerated wound of the neck, in which accident the internal carotid and the chief branches of the external carotid were wounded. The patient at first went on well; but, in the night, he became delirious and convulsed, and died about thirty hours after the ligature was applied. This case fell under my own notice, and the inference which I drew was, that the man died more from the great quantity of blood which he lost, and the severe mischief done to the parts in the neck, than from any effect of the ligature of the artery on the brain.

In another instance, in which the common carotid was tied, on account of a wound of the external carotid, by a musket-ball, complicated with fracture of the condyle and coracoid process of the lower jaw, every thing went on favourably until the seventh day after the operation. Neither the intellectual faculties, nor the functions of the organs of sense, had been at all disturbed. But, at that period, stupor, confusion of ideas, restlessness, a small unsteady pulse, discoloration of the face, and loss of strength came on, followed in the evening by a violent paroxysm of fever. On the eighth day, three copious hemorrhages took place from the whole surface of the wound, and, on the ninth, the man died. In this case, however, the affection of the brain, and the other unfavourable symptoms, would be ascribed by nobody to the effects of the ligature on the carotid, but every one would see the cause in the severe and extensive local mischief, produced partly by the musket-ball, and partly by the mode in which the operation was performed, the surgeon having extended his incisions from the carotid gland to within an inch of the clavicle! (*See Journ. Général de Med. &c. par Sedillot*.)

That the carotid may be tied without injuring the functions of the brain, and that aneurisms of this artery admit of being cured by the operation, is not fully proved. The following is the second instance, in which I have been present at the operation

of tying the carotid trunk on account of a wound.

A soldier of the 44th regiment was wounded in the neck, with a pike, at the battle of Waterloo, and was brought to Brussels. After he had been some little time in the hospital, the bleeding, which had stopped, recurred with great violence, both from the mouth and the external wound itself; and it was therefore judged necessary to tie the common carotid, which was done by my friend Mr. Collier. The operation was performed by making an incision along the inner edge of the sterno-cleido-mastoideus, raising this muscle from the sheath including the artery, &c. and holding aside the jugular and lower thyroid veins, which swelled up every instant to a very large size, so as to overlap the artery. This vessel being disengaged from the nerve, was then tied. Though the operation was done by candle-light, it was skilfully performed, and reflects great credit on Mr. Collier. A detail of the case may be found in a modern work. (*Med. Chir. Trans. vol. 7. p. 107.*)

Another example, in which the carotid artery was tied, and the patient saved, in a case where it was wounded with a penknife, has been recently published by Dr. John Brown, surgeon to the county of Meath Infirmary. (*See Dublin Hospital Reports, vol. 1. p. 301, &c.*) In this instance, the internal jugular vein "did not appear, nor was it a source of the slightest inconvenience during the operation." (P. 305.) A case, very analogous to the foregoing, is recorded by Mr. Hodgson, and the event equally successful. "The jugular vein afforded no trouble in the operation: it was not even seen." A gradual improvement of the power of deglutition marked the gradual subsidence of the tumour, which pressed against the pharynx. Nor was any change perceived in the state of the patient's mind after this operation, who remained as she had been previously, melancholy and dejected. (P. 332.)

Acrel mentions an example, in which the carotid artery was wounded by a gunshot, and the hemorrhage permanently stopped by compression. A similar case is related by Van Horne, in his annotations to the work of Botallus. (*De Vuln. Sclopetis.*) Baron Larrey has likewise related a case, in which the carotid was wounded by a musket-ball, and life saved by the instant application of pressure. (*Mém. de Chir. Mil. t. 1. p. 309.*) However, considering the size of the vessel, and its unfavourable situation for being effectually and steadily compressed, some doubts may be entertained, whether the vessel wounded might not rather have been one of its branches.

On Friday, November 1, 1805, Mr. A. Cooper operated on Mary Edwards, aged forty-four, who had an aneurism of the right carotid artery. At this time, the tumour reached from the vicinity of the chin to beyond the angle of the jaw, and downward to within two inches and a half from the clavicle.

The swelling had a strong pulsatory motion. The woman also complained of a particular tenderness of the scalp, on the same side of the head, and of such a throbbing in the brain, as prevented her from sleeping.

An incision, two inches long, was made at the inner edge of the sterno-cleido-mastoideus muscle, from the lower part of the tumour to the clavicle. This wound exposed the omo-hyoideus and sterno-hyoideus muscles, which being drawn aside towards the trachea, the jugular vein presented itself to view. The motion of this vein produced the only difficulty in the operation, as, under the different states of breathing, the vessel sometimes became tense and distended under the knife, and then suddenly collapsed. Mr. A. Cooper introduced his finger into the wound to keep the vein out of the way of the knife, and, having exposed the carotid artery by another cut, he passed two ligatures under this vessel by means of a curved aneurism-needle. Care was taken to exclude the recurrent nerve on the one hand, and the par vagum on the other. The ligatures were then tied about half an inch asunder; but the intervening portion of the artery was left undivided.

The pulsation of the swelling ceased immediately the vessel was tied, and, on the day after the operation, the throbbing in the brain had subsided, while no diminution of nervous energy in any part of the body could be observed.

The patient was occasionally afflicted with bad fits of coughing, but upon the whole, went on at first pretty well. On the eighth day, however, a paralysis of the left leg and arm was noticed, attended with a great deal of constitutional irritation. November 8th, the patient could move her arm rather better; but became unable to swallow solids. Nov. 12th, the palsy of her arm had now almost disappeared. The ligatures came away. November 14th, she was in every respect better; she swallowed with less difficulty; and the tumour was smaller, and quite free from pain. On the 17th, she became very ill; the tumour increased in size, and was sore when pressed. The wound was as large as immediately after the operation, and discharged a sanious serum. Great difficulty of swallowing, and a most distressing cough, were also experienced. The pulse was ninety-six, and the left arm again very weak. On the 21st, the patient died, the difficulty of swallowing having previously become still greater, attended with a further increase of the tumour, the skin over which had acquired a brownish red colour.

On opening the swelling after death, the aneurismal sac was found inflamed, and the clot of blood in it was surrounded with a considerable quantity of pus. The inflammation extended on the outside of the sac, along the par vagum, nearly to the basis of the skull. The glottis was almost closed, and the lining of the trachea was inflamed and covered with coagulating lymph. The

pharynx was so compressed by the tumour, which had been suddenly enlarged by the inflammation, that a bougie, of the size of a goose-quill, could hardly be introduced into the œsophagus. Mr. Cooper concludes with expressing his opinion, that *these causes of failure may, in future, be avoided by operating before the tumour is of such size as to make pressure on important parts; or, if the swelling should be large, by opening it, and letting out its contents, as soon as inflammation comes on.* (See *Med. Chir. Trans.* vol. 1.)

Mr. Cline operated for a carotid aneurism, December 16, 1808, in St. Thomas's Hospital. The tumour was very large, and had increased with great rapidity. The pressure of the swelling was such, as to interrupt both respiration and deglutition, and to put the larynx out of its natural position. The patient had besides a frequent and troublesome cough. The pain was confined to the tumour and same side of the face. These symptoms seemed relieved during the first twelve hours after the operation. They then became worse, particularly the cough and difficulty of breathing, and a violent irritative fever took place. The man died on the 19th of the same month. (See *London Med. Review*, No. 3.)

In the month of June, 1808, Mr. Astley Cooper operated, in Guy's Hospital, on a man, aged 50, who had a carotid aneurism attended with pain on one side of the head, throbbing in the brain, hoarseness, cough, slight difficulty of breathing, nausea, giddiness, &c. The patient got quite well, and resumed his occupation as a porter. There was afterwards no perceptible pulsation in the facial and temporal arteries of the aneurismal side of the face.

On the opposite side, the temporal artery became unusually large. The tumour was at last quite absorbed, though a pulsation existed in it till the beginning of September. The man's intellects remained perfect; his nervous system was unaffected; and the severe pain, which, before the operation, used to affect the aneurismal side of the head, never returned.

The swelling, at the time of the operation, was about as large as a pullet's egg, and situated on the left side about the acute angle, made by the bifurcation of the common carotid, just under the angle of the jaw.

Mr. A. Cooper began the incision opposite the middle of the thyroid cartilage, at the base of the tumour, and extended the wound to within an inch of the clavicle, on the inner side of the sterno-cleido-mastoideus muscle. On raising the margin of this muscle, the omo-hyoideus could be distinctly seen crossing the sheath of the vessels, and the nervus descendens noni was also brought into view. The sterno-cleido-mastoideus was now separated from the omo-hyoideus, when the jugular vein was seen. This vessel became so distended at every expiration as to cover the artery. When the vein was drawn to one side, the par vagum was manifest, lying between that

vessel and the carotid artery, but a little to the outer side of the artery. The nerve was easily avoided.

A double ligature was then conveyed under the artery with a blunt iron probe. The lower ligature was immediately tied, and the upper one was also drawn tight, as soon as about an inch of the artery had been separated from the surrounding parts above the first ligature, so as to allow the second to be tied at this height. A needle and thread were passed through the vessel below one ligature, and above the other. The artery was then divided. In a little more than nine weeks, the wound was quite healed, and the patient entirely recovered. (See *Med. Chir. Trans.* Vol. 1.)

Another successful instance, in which the carotid was tied for the cure of an aneurism, is related in a work, to which I always have the greatest pleasure in referring. (See *Hodgson's Treatise on the Diseases of Arteries*, p. 329.)

Mr. Travers, surgeon to St. Thomas's Hospital tied the carotid artery in a woman who had an aneurism by anastomosis in the left orbit. The disease had pushed the eye out of its socket. Two small ligatures were applied, which came away on the twenty-first and twenty-second day. No hemorrhage, nor impairment of the functions of the brain took place, and the disease in the orbit was effectually cured. (See *Med. Chir. Trans.* Vol. 2.)

Another highly interesting example, in which an aneurism by anastomosis in the orbit was effectually cured by tying the carotid artery, is recorded by Mr. Dalrymple, surgeon at Norwich. This gentleman performed the operation on the 12th of November, 1812. The patient was a female, aged 44. The protrusion of the eye was relieved in proportion as the swelling diminished. The violent headaches also subsided; but the eyesight was irrecoverably lost. (See *Med. Chir. Trans.* Vol. 6. p. 111.)

An interesting case, in which my friend Mr. Vincent tied the carotid trunk for an aneurism, is published in the 10th vol. of the latter work. (P. 212, &c.) In this example, the internal jugular vein did not appear to be at all in the way during the operation; some of the fibres of the omo-hyoideus, however, could not be conveniently drawn aside, and were therefore divided. A single ligature was applied; the pulsation in the tumour did not entirely cease, at first, when the artery was tied, but it did so two days afterwards; and the swelling was rapidly diminishing. The ligature came away about three weeks after the operation, and there was every hope of a cure; but between the fourth and fifth week, a considerable swelling occurred between the wound and the jaw, impeding deglutition, but not the breathing. This state was followed by febrile symptoms, increased difficulty of swallowing; an attack of coughing; and impeded respiration. In the hope of affording relief, an incision was made in the tumour, from which a small quantity of

pus and coagulum issued; but, it was in vain, for the patient was dying. On dissection, the carotid artery was found perfectly closed as far as the division of the arteria innominata. But, above where the ligature had been, the vessel was open and inflamed, and pus was found in it. The most remarkable circumstance noticed was globules of air, adhering to the inner surface of the aorta, and other large arteries, and found also under the tunica arachnoida. The bulk of the swelling in the neck depended upon effusion of serum in the cellular membrane.

In order to get at the carotid artery in the safest manner, Mr. Abernethy has recommended making an incision on that side of it which is next the trachea, where no important parts are exposed to injury, and then to pass a finger underneath the vessel. The par vagum must be carefully excluded from the ligature; for to tie it would be fatal. (*Surgical Observations*, 1804.)

The cure of carotid aneurisms by the operation has now been so often exemplified, that even to refer to every case upon record would demand more space than I can at present afford. A successful instance is reported by Macaulay (*Edin. Med. Surg. Journ.* April, 1814;) another by Dr. Post, who used two ligatures, and divided the artery in the space between them (*New England Journ. of Medicine and Surgery*, Vol. 3, p. 205, *Boston*, 1814;) another by Mr. Giles Lyford, proving the sufficiency of a single ligature, (*Med. Chir. Trans.* Vol. 11; p. 97, &c.) The case, in which Mr. Goodlad tied the carotid, in order to prevent hemorrhage in the removal of a tumour involving the parotid gland, is contained in Vol. 7, p. 112, &c. of the latter book.

The best anatomical engravings of the parts, concerned in the operation of taking up the carotid artery, are those by Rosenmüller. (See *Chirurg. Anatom. Abbildungen*, Thl. 1, tab. 7, 8, 9.)

For the particulars of a carotid aneurism cured by the ligature of the artery by M. Dumont, (See *Diss. sur l'Aneurisme de l'Artere carotide*, par P. J. Vanderhagen, Paris, 1815.) Walther of Landshut, in the year 1814, tied the carotid artery for the cure of an aneurism with complete success; he applied only a single ligature. (*Broschet, Fr. Transl. of Mr. Hodgson's work*, T. 2. p. 83.) In this translation are reported several instances, in which Dupuytren and other continental surgeons have applied a ligature to the carotid.

OF ANEURISMS OF THE AORTA, AND VALSALVA'S TREATMENT.

This afflicting and fatal disease is by no means unfrequent, and the arch of the aorta is the most common situation of the tumour. Dr. Hunter was of opinion, that the latter circumstance depended on the forcible manner, in which the blood, propelled from the left ventricle of the heart, must be driven against the angle of the curvature of the vessel.

Mr. A. Burns considered aneurism of the thoracic aorta more frequent, perhaps, than that of any other vessel in the body. "I have had (says he) an opportunity of examining fourteen, who had died of this disease, but have not seen more than three instances of external aneurism." (*On Diseases of the Heart*, &c. p. 215.)

These proportions, however, would not at all correspond to common observation, external aneurisms taken collectively, being supposed to be about as numerous, as those of the aorta alone, a calculation long ago made by Dr. A. Monro, primus.

It was the opinion of Dr. W. Hunter, that the aneurismal sac was composed of the dilated coats of the artery, which parts nature thickened and studded with ossifications, after the origin of the disease, for the purpose of resisting its increase. Mr. Hodgson also in his late excellent publication, declares his decided belief, and adduces facts to prove, that many aneurisms of the aorta are formed by dilatation. Scarpa argues, however, that the generality of aneurisms of the aorta are the consequence of a rupture of the proper coats of this large vessel; and that the cellular sheath of the artery is what becomes distended into the thickened and ossified aneurismal sac.

Dr. W. Hunter considered the ossifications of the sac as consequences of the disease; but Haller looked upon such scales of bone in the aorta as the very cause of the affection, by rendering the artery inelastic and incapable of yielding to each pulsation of the heart.

It is unquestionably true, that aneurisms of the aorta are most common in persons who are advanced in life, and, it is equally well known, that the aorta of every old subject, whether affected with aneurism, or not, is almost always marked in some place or another, with ossifications, or, rather, with calcareous concretions. Such productions appear to occasion a decay, or absorption of the muscular and inner coats of the vessel, so that at length the force of the blood makes the artery give way, and this fluid, collecting on the outside of the laceration, or rupture, gradually distends the external sheath of the artery into the aneurismal sac, which itself becomes at last of considerable thickness, and studded with ossified specks.

"If any person, who is not prejudiced in favour of the common doctrine, with regard to the nature and proximate cause of this disease, (says Scarpa) will examine, not hastily and superficially, but, with care and by dissection, the intimate structure and texture of the aneurism of the aorta, unfolding with particular attention the proper and common coats of this artery, and, in succession, those which constitute the aneurismal sac, in order to ascertain distinctly the texture and limits of both, he will clearly see, that the aorta, properly speaking, contributes nothing to the formation of the aneurismal sac, and, that, consequently, the sac is merely the cellular membrane, which, in the

sound state, covered the artery, or that soft cellular sheath, which the artery received in common with the neighbouring parts. This cellular substance, being raised and compressed by the blood, effused from the corroded or lacerated artery, assumes the form of a circumscribed tumour, covered externally, in common with the artery, by a smooth membrane, such as the pleura in the thorax, and the peritoneum in the abdomen."

Scarpa then comments upon the differences of mere dilatation of an artery from aneurism, a subject which has been already fully considered in the foregoing pages. (*Scarpa on the Anatomy, Pathology, and Surgical Treatment of Aneurism, Transl. by Wishart, p. 55, 56.*)

As I have already explained in the foregoing pages, the sentiments of this eminent anatomist are not adopted by the generality of surgeons; or rather his doctrine is not carried by others to the extent which he has insisted upon, and it would be useless repetition to bring before the reader again the facts, which prove that his statements are liable to many exceptions. A case, however, recited by Roux, which I have met with since the foregoing pages were printed, merits notice; it was an instance, in which a popliteal aneurism, unattended with pulsation, had been mistaken for an abscess, and punctured, whereby the patient lost his life. On dissecting the limb, Roux says, "the three coats of the artery participated in the dilatation, and the case was one of the clearest specimens, which I have ever seen of a true aneurism." (*Nouveaux Elements de Med. Opératoire, T. 4, 517.*)

All arguments, brought against the possibility of a dilatation of the inner coat, and founded on the inelastic structure of that membrane, must likewise be completely refuted by another fact, demonstrated by morbid preparations, collected by Dubois and Dupuytren where the inner coat of the aorta is alone dilated, protruding through the outer tunics, in the form of a distinct swelling, somewhat like a hernia. (*Roux Op. cit. p. 49.*)

In whatever manner aneurisms of the aorta are formed, there are no diseases, which are more justly dreaded, or which more completely fill the surgeon, as well as the patient, with despair. No affliction, indeed, can be more truly deplorable; for, the sufferings, which are occasioned, hardly ever admit even of palliation, and the instances of recovery are so very few, that no consolatory expectation can be indulged of avoiding the fatal end, to which the disease naturally brings the miserable sufferer.

The existence of aneurisms of the aorta is scarcely ever known with certainty, before they have advanced so far as to be attended with an external pulsation, and a tumour, that admits of being felt, or even seen. In very thin subjects, the throbbing of the abdominal aorta is sometimes unusually plain through the integuments and

viscera, and this has occasionally given rise to the suspicion of an aneurism; a circumstance, which deserves to be remembered by every surgeon, desirous of not pronouncing a wrong opinion. The preternatural pulsations, however, which are liable to be mistaken for those of aortic aneurisms, are of various kinds, and form a subject, to which the attention of Dr. Albers of Bremen, the late Mr. A. Burns, and others, has been very usefully directed. (*See Abdomen.*)

While thoracic aneurisms of the aorta are accompanied with no degree of external swelling, the symptoms are all equivocal, and might depend on a disease of the heart, angina pectoris, phthisis pulmonalis, &c. Violent and irregular throbbings frequently occur between the fourth and fifth true ribs of the left side: the same irregularity of the pulse prevails as often proceeds from organic affections of the heart; the respiration is exceedingly obstructed; the voice altered; and, in a more advanced period of the malady, the patient is at times almost suffocated. The pressure of the internal swelling on the trachea, bronchia, and lungs, is sufficient to account for this difficulty of breathing. In many instances, the irritation and compression, produced by the tumour, occasion an absorption of the greater part of the lungs, and abscesses and tubercles throughout the portion which remains. Even the function of deglutition suffers interruption in consequence of the pressure made on the œsophagus, which may even be in a state of ulceration. Thus, in an example recently published, we read that "the cavity of the windpipe was nearly obliterated from the pressure of the aneurism; and the extremities of four of its cartilages lay in the œsophagus, having entered that canal, through an ulcer in its coats." (*Trans. of a Society for the Improvement of Med. and Chir. Knowledge, V. 3. p. 83.*)

After what has been stated, it cannot be surprising, that, ere the disease manifests itself externally, affections of the lungs, or strictures of the œsophagus, should often be suspected. (*Hodgson, p. 91.*)

An aneurism of the arteria innominata, not discovered till after the patient had died of suffocation, gave rise to great difficulty of drawing air into the chest, without any other symptom calculated to throw light on the nature of the disease. The aneurismal swelling was situated behind the first bone of the sternum, and pressed upon the trachea. The front of this tube was pushed in by the tumour, so as to present a convex prominence on the inner surface, which, however, diminished its area in a very slight degree. Mr. Lawrence adduces this fact to prove, that spasm of the aircells may be the cause of great distress in breathing. "The termination of this case (says he) is the more remarkable, inasmuch as in another patient, an aneurism rising out of the arch of the aorta, and pressing on the corresponding part of the trachea, so as to

produce ulceration of the internal membrane, under which there was a slight appearance of coagulated blood, caused no affection of the breath at all. The person died of a different complaint, and the discovery of the aneurismal tumour, which was very small, and filled with firm laminated coagula, was quite accidental." (*Med. Chir. Trans. Vol. 6. p. 227.*)

Thus, we find, in thoracic aneurisms, at least, previously to their attainment of a certain size, that no regularity prevails even with regard to difficulty of breathing, the symptom, which *a priori* one might suppose would invariably be present.

I have mentioned, that the symptoms of thoracic aneurisms, previously to the formation of any outward swelling, often resemble those of phthisis, and the latter is sometimes actually supposed to be the disease under which the patient is labouring. But, there is one distinction between the cases, which is pointed out by Mr. Hodgson, and may be of use, in combination with other circumstances, in facilitating the diagnosis: "in phthisis, the expectoration is either puriform, or thick, and clotted; but, in aneurisms, which are not accompanied with disease in the lungs, as far as I have observed, it always consists of a thin frothy mucus." (*On Diseases of Arteries, &c. p. 98.*)

According to Kreysig's experience, the cough comes on at irregular periods, is violent, and attended with great efforts, the expectorated matter being forced up by the vehemence. He agrees with Mr. Hodgson, respecting the general quality of what is expectorated, where thoracic aneurisms are not complicated with diseased lungs; but, he says, that the matter coughed up, also, frequently consists of masses of lymph, blended with brick-red particles of blood, which masses, when thrown into water, seem as if they were composed of a ball of stringy substances. (*German Transl. of the latter work, p. 137.*)

From a review of many cases of aortic aneurisms, Mr. A. Burns was inclined to think, that when the ascending aorta is aneurismal, the breathing is more affected, than when the arch of the vessel is enlarged, but, that in the latter case, the impediment to deglutition is greatest. (*On Diseases of the Heart, &c. p. 244.*)

The way, in which aneurisms of the thoracic aorta prove fatal, is subject to considerable variety. These swellings do not always destroy the patient by hemorrhage: in numerous instances, the magnitude of the disease so impedes respiration, that death seems induced by suffocation, and not a drop of blood is found internally effused. Frequently, (to use the description of Mr. John Bell) before the awful and fatal hemorrhage has had time to occur, the patient perishes of sufferings too great for nature to bear. The aneurismal tumour so fills the chest, so oppresses the lungs, compresses the trachea, and curbs the course of the descending blood, that the system, with

a poor circulation of ill-oxydated blood, is quite exhausted. And, thus, though the patient is saved from the most terrible scene of all, he suffers great miseries; he experiences in his chest severe pains, which he compares with the stabbing of knives; terrible palpitations; an awful sense of sinking within him; a sound within his breast, as if of the rushing of waters; a continual sense of his condition; sudden startings during the night; fearful dreams and dangers of suffocation, until with sleepless nights, miserable thoughts by day, and the gradual decline of an ill-supported system, he grows weak, dropsical, and expires. (*See Anatomy of the Human Body, by John Bell, Vol. 2, Edit. 3. p. 234, 235.*)

Mr. A. Burns saw two examples, in which the patients died instantaneously, though their aneurismal tumours were very small, and had not burst. Both these patients were in the early stage of pregnancy. (*On Diseases of the Heart, p. 236.*)

The situations, in which aneurisms of the curvature of the aorta burst, are different in different cases. Sometimes the swelling bursts into the cavity of the chest, or that of the pericardium, and the patient drops suddenly down. When the coats of the aorta give way within the pericardium, where they only receive a slight external membranous covering, this is apt to be also ruptured at the same time, so as to bring on copious effusion of blood, which oppresses the action of the heart, and produces immediate death. In other examples, the blood is effused into the trachea, or bronchia, and the patient, after violent coughings and ejections of blood from the mouth, expires.

Sometimes, after the tumour has become closely adherent to the lungs, it bursts into the aircells, through which the blood is widely diffused. An example of this termination of the disease was observed by Laennec; who also saw another case, in which, if the patient had lived a little longer, the same occurrence in all probability would have happened. Ehrhardt says, that he is not aware that this mode of rupture has been noticed by other writers. (*De Aneurysmate Aortæ, p. 21, 4to. Lips. 1820.*)

In certain cases, the swelling beats its way through the ribs, destroys the vertebrae, and injures the spinal marrow, so that the patient suffers a species of death, somewhat less violent and sudden. But, although aneurisms in the chest do sometimes present at the back, a circumstance, that depends on the particular situation of the disease, (*See Pelletan's Clinique Chirurgicale, Tom. 1, Obs. 7, p. 84.*) they more commonly rise towards the upper part of the breast, where a throbbing tumour occurs, which has caused an absorption of the opposing parts of the ribs, and sternum: and sometimes dislocated the clavicles. Corvisart saw an instance, in which an aneurism of the aorta had dislocated the sternal extremity of the clavicle; and Duverney makes mention of a case, in which, besides the displacement

and injury of the clavicle, the sternum and scapula were partially destroyed. Guattani speaks of an example, in which the clavicle was bent by a large aneurism, of which a portion, as large as a pigeon's egg, projected above the bone. (*Lauth, p. 168.*) And Morgagni has described a case, where the upper bone of the sternum, the sternal ends of the clavicles, and the adjoining ribs, were destroyed by the pressure of a large aneurism of the front of the curvature of the aorta, and the disease presented itself externally somewhat in the form of a bile. (*Epist. 26, art. 9.*)

The swelling now pulsates in an alarming way. The blood is only retained by a thin covering of livid skin, which is becoming thinner and thinner. At length, a point of the tumour puts on a more conical, thin, and inflamed appearance than the rest; a slough is formed, and, on this becoming loose, the patient is sometimes instantaneously carried off by a sudden gush of blood.

An extraordinary case of aneurism of the aorta is related by Dr. C. W. Wells. The disease, being unattended with any external swelling, it seems, was not comprehended during the patient's lifetime.

The following is an abstract of the symptoms, and particulars of the case. Mr. A. B. a gentleman, thirty-five years of age, and temperate in his habits, became affected in 1789 with symptoms, which were thought to denote the approach of pulmonary consumption. These, however, after some time, entirely disappeared. In 1798, he was attacked with a slight hemiplegia, from which he also recovered, with the exception of an inconsiderable sense of coldness in the foot, which had been paralytic. In March, 1804, he complained of being frequently troubled with a noise in his ears, flatulence in his bowels, and pains in his hands and feet, sometimes attended with slight swellings in the same parts. From one or more of these symptoms, he was never afterwards quite free; but, he did not complain of any unusual feelings in his chest. August 11, 1807, he fatigued himself considerably with walking; ate rather a hearty dinner; and, having refreshed himself with some sleep afterwards, he played about with his children. While thus amusing himself, he was suddenly seized, between eight and nine o'clock, with great oppression in his chest. He soon afterwards became sick, and in the matter thrown up, some streaks of blood were observed. He now went to bed; but, though the weather was warm, and he was covered with bed-clothes, his skin felt cold to the attendants. At midnight, he laboured under a constant cough, and expectorated mucus tinged with blood. His body was moistened with a cold sweat, and his pulse was extremely feeble; sometimes, it was scarcely perceptible. About five in the morning, his pulse was feeble and irregular; his breathing difficult, his skin pale, and cold, and covered with a clammy sweat.

He frequently tossed, and writhed his body, as if he was suffering great pain or uneasiness. The mental faculties, however, seemed unimpaired. Shortly afterwards he expired, having complained, just before his death, of much heat in his chest, and thrown off the bed-clothes.

The most remarkable circumstance found on opening the body, is thus recorded: "The ascending aorta was distended to about the size of a large orange. The tumour adhered to the pulmonary artery, just before its division into the right and left branches. Within the circumference of this adhesion there was a narrow hole, by means of which a communication was formed between the two arteries."

Dr. Wells concludes with observing, that, though such a disease might easily have been imagined, he had found no instance of it in books, and that it had not been observed by any of the surgeons, or anatomists in London. He supposed, that the communication, between the aorta and pulmonary artery, took place on the evening before the patient's death, when the oppression of the chest was first felt: and that, in consequence of the superior strength of the left side of heart, a part of the blood, which was thrown into the aorta, must have been forced into the pulmonary artery, from which circumstance, he conjectures most of the symptoms originated. (*Trans. of a Society for the Improvement of Med. and Chir. Knowledge, Vol. 3, p. 85.*)

The bursting of an aneurism of the aorta into the pulmonary artery is then another possible mode, in which the disease may prove fatal.

Besides the example of this nature, reported by Dr. Wells, several others are detailed by writers. (See *Bulletin de la Faculté de Médecine, No. 3, in which there are two cases; Sue, in Journ. de Med. continué, T. 24, p. 124; and in Bulletin de la Faculté, &c. T. 17, p. 16.*)

Aneurisms of the arch of the aorta are stated to have adhered to, and burst into the right auricle of the heart, and thus to have produced instant death. (See *Med. Chir. Journ. Vol. 6, p. 617. Bulletin de la Société de Médecine à Paris, 1810, No. 3, p. 38.*)

Cases, in which aneurisms of the thoracic aorta, burst into the œsophagus, are uncommon. Bonetus and Morgagni record no examples of this event; nor are there any in the comprehensive treatises of Scarpa and Hodgson. Corvisart speaks of an instance, which had been seen by Dupuytren, of which, however, no description is given. Yet, the possibility of the occurrence is not a matter of speculation, or doubt.

A case of this description is noticed by Matani (*De Aneurism. Præcordiorum Morbis, p. 120*); another is alluded to by Ehrhardt, as being related by Copeland, (*Comment De Aneurismate Aortæ, p. 22, et Cerutti Catal. Præp. Pathol.*) and an instance is described by Bertin, (See *Bulletins de la Faculté de Med. 1810, p. 14.*)

Sanvages is one of the few writers, who

have adduced proofs of this mode of rupture: *cadavere aperto, inveni ventriculum septem vel octo libris sanguinis distensum, aortam ad brachii magnitudinem, per spatium septem vel octo pollicum dilatatam, et orificium denarii magnitudine aortæ et œsophago continuo commune, quod tamen quinque cristæ carneæ, veluti valvulæ ex ambitu orificii oriundæ et circumpositæ potuerunt obturare. Per hoc orificium, sanguis ex aorta fluxerat in œsophagum.* (Nos. Method. T. 2, p. 298.) A similar case has been recently published by Bricheteau. (See *Bulletin de l'Athénée de Med. de Paris*, Dec. 1816.)

Laennec met with an aneurism of the descending aorta, where the tumour had made such pressure on the thoracic duct, that this tube was partly destroyed, and all the lymphatic vessels were found uncommonly purged. (*Journ. de Med. par Corvisart*, T. 2, p. 15.) With the exception, perhaps, of one instance given on the authority of Lancisi, (*Lauthii Collect.* p. 38,) no other example of this description is upon record.

An instance is reported by Corvisart, in which the pressure of an aneurism of the ascending aorta had nearly obliterated the termination of the lower vena cava, and a fatal attack of apoplexy was the consequence. (*Mal. du Cœur*, p. 342.)

It is well worthy of notice, that aneurisms of the arch of the aorta may occasion a tumour, so much like that of a subclavian aneurism, as to be in danger of being mistaken for the latter disease. An example of this kind is related by Mr. Allan Burns: "a case," says he, "on which several of the most distinguished practitioners in Edinburgh, and almost every surgeon in Glasgow, were consulted. The nature of the disease appeared to be so decided, and its situation in the subclavian artery so clear, that, on that subject, there was no difference of opinion. Some were, however, of opinion, that an operation might be performed, while others were fully convinced, that the case was hopeless. For myself, I must confess, that I was firmly persuaded, that, in the early stage of the disease, an operation might have been beneficial," &c. (*Surgical Anatomy of the Head and Neck*, p. 30.) After death, the vessel, which was supposed to have been most materially affected, was found perfectly healthy. (P. 39.)

After detailing all the particulars of this interesting case, Mr. A. Burns observes, that "it corroborates Mr. A. Cooper's remark, that aneurism of the aorta may assume the appearance of being seated in one of the arteries of the neck; an inference, drawn from the examination of a case, which came under his own observation, and of which he had the goodness to transmit a short history to me, along with a sketch, illustrative of the position of the tumour. In one case, the aneurism was attached to the right side of the aortic arch, and involved a part of the arteria innominata; in Mr. Cooper's the tumour arose from the left side of the arch, from between the roots of the left subclavian and carotid arteries. It formed a florence

flask-like cyst, the bulbous end of which projected at the root of the neck, from behind the sternum, and so nearly resembled aneurism of the root of the carotid artery, that the practitioner, who consulted Mr. Cooper, actually mistook the disease for carotid aneurism." (*Allan Burns, Op. cit.* p. 41.)

The preceding statement has received full confirmation from the observations of an intelligent writer. "I have seen (says Mr. Hodgson) several cases of aneurism, arising from the superior part of the arch of the aorta, which protruded above the sternum and clavicles, and, in one instance, the space between the tumour and the sternum was so considerable, that it was proposed to tie the carotid artery for an aneurism, which dissection proved to arise from the origin of the arteria innominata; and from the arch of the aorta." (*On the Diseases of Arteries and Veins*, p. 90.)

As we have already noticed, aneurisms of the aorta are most frequent at its curvature; but, they are also met with on the other portion of this vessel in the thorax, and likewise on that part of it, which is below the diaphragm. In subjects, predisposed to aneurisms, such swellings are frequently seen affecting various parts of the aorta at the same time.

When the disease occurs in the abdominal aorta, a preternatural pulsation generally becomes perceptible at some particular point. The pressure of the tumour interferes with the functions of the viscera; the breathing is rendered difficult by the swelling resisting the descent of the diaphragm; the patient suffers at times excruciating internal pains; sometimes he is affected with costiveness; sometimes, with diarrhœa; and not unfrequently with incontinence of the urine and feces. At length, an immense external swelling is formed, which pulsates alarmingly, and, if the patient survives long enough, destroys him by a sudden external, or internal effusion of blood.

Aneurisms, within the thorax and abdomen, being entirely out of the reach of operative surgery, have been too commonly abandoned as unavoidably fatal, and when any thing has been done in such cases, it has generally been only with a view of palliation. Moderating the force of the circulation by bleedings and low diet, avoiding every thing that has the least tendency to heat the body, or quicken the motion of the blood, keeping the bowels well open with laxative medicines, and lessening pain with opiates, have been the means usually employed. Of late years, also, digitalis, which has a peculiar power of diminishing the action of the sanguiferous system and impetus of the blood, has been prescribed, with every appearance of benefit.

That the diminution of the force of the circulation will prevent the increase of an aneurism, Mr. Hodgson considers illustrated by the following circumstance: if two sacs exist in the course of the same artery, the obstruction, which is caused by the passage of blood into the upper, removes the force

of the circulation from the lower, which becomes stationary, or its cavity is obliterated with coagulum. (*On Diseases of Arteries*, &c. p. 149.)

It was the opinion of the celebrated Valsalva, that the utility of a lowering plan of treatment might do more, than merely retard the death of aneurismal patients. It was his belief, that the method might entirely cure such aneurisms as had not already made too much progress; and he put it into practice with such rigour and perseverance, that the treatment became considered as particularly his own. The plan alluded to, is not described in his writings; but was published in the first volume of the *Commentaries of the Academy of Bologna*, by Albertini, one of his fellow-students; and several persons, who had learnt this method of Valsalva, afterwards imparted it to others. Thus, as Morgagni was passing through Bologna, in 1728, Stancazi, a physician of that place, is said to have informed him of Valsalva's practice. (See on this subject, *Kreysig, über die Herkrankheiten*, B. 2, p. 728.)

After taking away a good deal of blood by venesection, Valsalva used next to diminish the quantity of food gradually, till the patient at length was allowed only half a pint of soup in the morning, and a quarter of a pint in the evening, and a very small quantity of water, medicated with mucilage of quinces, or with the lapis of osteocolla. When the patient had been so reduced as to be incapable of getting out of his bed, Valsalva used to give him more nourishment till this extreme debility was removed. Valsalva was sure, that some aneurisms, thus treated, had got well, because every symptom disappeared, and his conviction was verified by an opportunity which he had of dissecting the body of a person that had been cured of this disease, and afterwards died of another affection; for the artery, which had been dilated, was found contracted, and in some degree callous.

Morgagni relates, that this method of treating aneurisms, is somewhat like the plan, which Bernard Gengha tried with success, as well as Lancisi, and he refers us to the 24th chapter of the 2d vol. of the *Anatomy of the one*, and to lib. 2. cap. 4, of the *Treatise on the Heart and Aneurisms*, of the other. But, Sabatier tells us, that, in consequence of this instruction, he examined both these works, without finding any thing on the subject. However this may be, we are informed by the latter, that he has seen the good effects of the practice in an officer, who had an alarming aneurism in front of the humeral extremity of the clavicle, in consequence of a sword wound in the axilla. The patient, after having been bled several times, was confined to his bed, and kept to an extremely low diet. He was allowed, as drink, only a very acid kind of lemonade. He took pills containing alum, and the swelling was covered with a bag full of tan mill dust, which was every now and then well wet with port

wine. By a perseverance in this treatment, the swelling was reduced to a smallish hard tubercle, having no pulsation, and a perfect cure ensued. (See *Sabatier Médecine Opératoire*, Tom. 3, p. 170—172.)

A French surgeon named Guérin, has written in favour of the efficacy of applying ice water, or pounded ice, to aneurismal swellings; a plan, which he represents, as being often of itself sufficient to effect a cure. This topical employment of cold applications may be rationally and conveniently adopted in conjunction with Valsalva's practice.

The most interesting and convincing facts, in proof of the efficacy of this mode of treatment, were published a few years ago by Pelletan. Indeed, upon the whole, I have no hesitation in saying, that I never read any modern collection of surgical cases, which have appeared to me more valuable, than those which compose the *Clinique Chirurgicale* of this experienced writer. The following extract from a well-written critique on this work will serve to convey to the reader some idea of the important information contained in the memoir on internal aneurisms. "The intent in the treatment is to reduce the patient gradually to as extreme a degree of weakness, as is possible, without immediately endangering life. It is done by absolute rest, a rigorous diet, and bleeding; to these means, M. Pelletan adds the external application of ice, or cold and astringent washes, &c. He has here detailed many cases from his own practice, of partial, or complete success, which cannot be too generally known, as they may be the means of creating in some, and of confirming in others, a good opinion of the only method of treatment, which has been found at all efficacious in a dreadful, and not unfrequent, organic disease.

"Of the cases here recorded, some appear to have been cured; in others, the treatment had marked good effects. In extreme cases, at best, it afforded but partial and temporary relief. We can notice but a few of these cases, which are, in every respect, highly interesting. In one, a robust man, an aneurism at the root of the aorta, with a pulsating tumour of the size of an egg, projecting between the ribs, (the edges of which were already partly absorbed) was reduced, so as to recede within the ribs in the course of eight days. At the end of this time, the patient refused to submit any longer. The tumour did not appear again for nearly a year, although he returned to very drunken and irregular habits. He died in about two years and a half, with the tumour again appearing, and much increased in volume. The aneurismal sac communicated with the aorta, by a smooth and round opening, opposite to one of the sigmoid valves. There can be no doubt of the efficacy of the treatment in this case; and it is highly probable, that his health and his life might have been long preserved, but for his own indiscretion. In a case

somewhat similar, but not so far advanced, the patient appears to have been cured. There was a swelling on the right side of the breast, about six inches in circumference, with a very strong beating. The pulsation was accompanied with a pain, which stretched towards the scapula and the occiput. It was evident, that the disease was an aneurism of the great arch of the aorta. The patient was a crier, of a strong frame, who was accustomed to drink freely. In the four first days, he was bled eight times, drawing three basins, "palettes," in the morning, and two in the evening. On the fifth, the pains and the beating were much lessened, but the pulse was still full. He was again bled once. The pulse was in a favourable state, as to strength, till the seventh day, when it again rose, and the man was twice bled.

During this time, the man was kept to a most rigorous diet. A cold poultice of linseed and vinegar was placed on the tumour, and renewed when it became warm. At the end of eight days, the good effects of this plan were very evident; the pain and the pulsation were gone. The patient, though weak, was in health and tranquil. He was now allowed more food by degrees. At the end of four weeks from the commencement of the treatment, he left the Hôtel Dieu well. He afterwards led a sober life, and became fatter, without any vestige of disease, except a slight and deep pulsation at the part, in which the aorta may always be felt beating in its natural state. He died two or three years after, of another complaint. His death was not known, and the body was not examined. (See *London Med. Review*, Vol. 5, p. 123.)

Pelletan also cured by similar treatment a large axillary aneurism, which was deemed beyond the reach of operative surgery. On the thirteenth day, the patient was reduced to a degree of weakness, which alarmed many of the observers. From that time, all pulsation in the tumour ceased. The contents were gradually absorbed; and the patient returned to his former laborious life with his arm as strong as ever. The pulse at the wrist was lost in consequence of the obliteration of the axillary artery, and the limb only receiving blood through the branches of the subclavian artery. "*Il y a beaucoup d'exemples, d'aneurismes gueris spontanément et sans le secours de l'art; (says Pelletan) mais on ne peut leur comparer le cas que nous venons de décrire; l'état extrême de la maladie, l'énergie des moyens employés, et l'effet immédiat et successif qui en est résulté, prouvent assez que le succès a été dû tout entier à l'art.*" (*Clinique Chirurgicale*, Tom. 1, p. 80.)

In this work, we find not less than three cases, in which aneurism of the aorta is stated to have been effectually cured. One instance was greatly relieved; but, the disease returned, the next year, in consequence of the patient's intemperate mode of life. In another example, an aneurism at the origin of the aorta was cured; but, the disease

recurred in another part of that vessel further from the heart. Even such cases as proved incurable, to the number of fourteen, all received various degrees of palliation from the treatment adopted.

In a modern work of great merit, several other instances are adduced, in which the utility and efficacy of a debilitating plan of treatment are illustrated. (See *Hodgson's Treatise on the Diseases of Arteries*, p. 146, 147, &c. &c.) In the same publication, as I have previously explained, there are several interesting facts, which tend to prove, that when the aneurism of the aorta is lessened, or cured, this great vessel itself may remain pervious. The progress of the disease is stopped by the blood coagulating in the sac, and closing the communication between the cavity of the aneurism, and that of the artery.

It must be confessed, in regard to Valsalva's mode of treatment, that some experienced men do not place confidence in it. Boyer declares himself against it, as not being really efficacious; and he states, that some time ago, it was tried twice in the Hôtel Dieu of Paris. The first trial was made on a patient with an axillary aneurism, which could not be operated upon on account of its situation; the second a woman, who had an aneurism of the abdominal aorta. In both cases, the tumour was large, and its parietes reduced to the cellular coat, and the surrounding cellular substance. In these two aneurisms, the progress of the swelling was much more rapid, and its rupture happened precisely at the moment when the treatment had been pushed to the utmost, and there ought to have been the greatest hope. (*Traité des Maladies Chir. T. 2, p. 121.*)

Roux expresses his entire disbelief in the possibility of an aneurism of the aorta being ever completely cured by Valsalva's mode of treatment, because he imagines, that such change could not happen without the tube of that great vessel becoming impervious, and of the lower parts of the body then perishing from stoppage of the circulation. But, he bears witness to the utility of such treatment, and recites a case, which he attended himself, where an aneurism made a considerable projection on the left side of the sternum, where the cartilages of the third and fourth ribs were raised, the throbbings very forcible, and the sense of suffocation such, that the patient was obliged to keep himself constantly quiet; yet, says Roux, though the disease now exists, it forms no prominence on the chest; the pulsations can only be obscurely felt between the ribs; respiration is but slightly oppressed; and the patient is capable of attending to his business. (*Nouveaux Elémens de Médecine Opératoire*, T. 1, p. 510, 5vo. Paris, 1813. Fr. Torti, *De Aortæ Aneurysmate Observationes binæ, cum animadv. Pouli Valcarenghi*, 8vo. Cremonæ, 1741. D. Sommer, *Dis. Sistens Aneurysma-*

tis Aortæ Pleuritidem mentientis Casum. Svo. Berol. 1816.)

ANEURISMAL VARIX, VARICOSE, OR VENOUS ANEURISM.

By these terms, surgeons mean a tumour, arising from a preternatural and direct communication, formed between a large vein and a subjacent artery. Thus, in venesection, performed immediately over the artery at the bend of the elbow, if the lancet be carried too deeply, it may transfix the vein, and wound the artery, in which event, the arterial blood, in consequence of the proximity of the two vessels, instead of being effused into the cellular substance, will pass directly into the cavity of the vein, which will become dilated in the form of a varix by the jet of arterial blood into it.

Although Sennertus probably referred to an instance of this disease, (*Op. T. 5, l. 5, cap. 43.*) Dr. W. Hunter is undoubtedly the first who gave an accurate description of it. Scarpa is disposed to claim a share of the merit for his countryman Guattani; but, as Mr. Hodgson has remarked, Dr. Hunter's observations on this disease were published in the years 1757, and 1764, whereas, Guattani did not see his first patient until the year 1769, and his book was not published until the year 1772.

"Does it ever happen in surgery," says Dr. Hunter, "that when an artery is opened through a vein, a communication or anastomosis, is afterwards kept up between these two vessels? It is easy to conceive this case, and it is not long since I was consulted about one, that had all the symptoms that might be expected, supposing such a thing to have actually happened, and such symptoms, as otherwise must be allowed to be very unaccountable. It arose from bleeding; and was of some years standing, when I saw it about two years ago, and I understand very little alteration has happened to it since that time: The veins, at the bending of the arm, and especially the basilic, which was the vein that had been opened, were there prodigiously enlarged, and came gradually to their natural size, at about two inches above, and as much below the elbow. When emptied by pressure, they filled again almost instantaneously, and this happened, even when a ligature was applied tight round the fore-arm, immediately below the affected part. Both when the ligature was made tight, and when it was removed, they shrunk, and remained of a small size, while the finger was kept tight upon the artery, at the part where the vein had been opened in bleeding. There was a general swelling in the place, and in the direction of the artery, which seemed larger, and beat stronger, than what is natural, and there was a tremulous jarring motion in the vein, which was strongest at the part, which had been punctured, and became insensible at some distance both upwards and downwards." (*Med. Obs. and Inq. V. 1.*)

In the second volume of this work, Dr.

Hunter adds some further remarks on the aneurismal varix.

"In the operation of bleeding, the lancet is plunged into the artery through both sides of the vein, and there will be three wounds made in these vessels, viz. two in the vein, and one in the artery, and these will be nearly opposite to one another, and to the wound in the skin. This is what all surgeons know has often happened in bleeding, and the injury done the artery is commonly known by the jerking impetuosity of the stream, whilst it flows from the vein, and by the difficulty of stopping it, when a sufficient quantity is drawn.

"In the next place, we must suppose, that the wound of the skin, and of the adjacent, or upper side of the vein, heal up as usual; but, that the wound of the artery, and of the adjacent, or under side of the vein, remain open, (as the wound of the artery does in the spurious aneurism,) and, by that means, the blood is thrown from the trunk of the artery, directly into the trunk of the vein. Extraordinary as this supposition may appear, in reality it differs from the common spurious aneurism in one circumstance only, viz., the wound remaining open in the side of the vein, as well as in the side of the artery. But this one circumstance will occasion a great deal of difference in the symptoms, in the tendency of the complaint, and in the proper method of treating it: upon which account, the knowledge of such a case will be of importance in surgery.

"It will differ in its symptoms from the common spurious aneurism, principally thus:—

"The vein will be dilated, or become varicose, and it will have a pulsating jarring motion on account of the stream from the artery. It will make a hissing noise, which will be found to correspond with the pulse for the same reason. The blood of the tumour will be altogether, or almost entirely fluid, because kept in constant motion. The artery, I apprehend, will become larger in the arm, and smaller at the wrist, than it was in the natural state; which will be found out by comparing the size, and the pulse, of the artery in both arms, at these different places. The reason of which I shall speak of hereafter; and the effects of ligatures, and of pressure upon the vessels above the elbow and below it, will be what every person may readily conceive, who understands any thing of the nature of arteries and veins in the living body.

"The natural tendency of such a complaint will be very different from that of the spurious aneurism. The one is growing worse every hour, because of the resistance to the arterial blood, and if not remedied by surgery must at last burst. The other, in a short time, comes to a nearly permanent state; and, if not disturbed, produces no mischief, because there is no considerable resistance to the blood, that is forced out of the artery.

"The proper treatment must, therefore,

be very different in these two cases, the spurious aneurism requiring surgical assistance, as much, perhaps, as any disease whatever; whereas, in the other case, I presume it will be best to do nothing.

"If such cases do happen, they will no doubt be found to differ among themselves, in many little circumstances, and particularly in the shape, &c. of the tumefied parts. Thus the dilatation of the veins may be in one only, or in several, and may extend lower, or higher, in one case, than in another, &c. according to the manner of branching, and to the state of the valves in different arms. And the dilatation of the veins may also vary on account of the size of the artery, that is wounded, and of the size of the orifice in the artery and in the vein.

"Another difference in such cases will arise from the different manner, in which the orifice of the artery may be united or continued with the orifice of the vein. In one case, the trunk of the vein may keep close to the trunk of the artery, and the very thin stratum of cellular membrane between them, may, by means of a little inflammation and coagulation of the blood among its filaments, as it were, solder the two orifices of these vessels together, so that there shall be nothing like a canal going from one to the other; and then the whole tumefaction will be more regular, and more evidently a dilatation of the veins only. In other instances the blood, that rushes from the wounded artery, meeting with some difficulty of admission and passage through the vein, may dilate the cellular membrane, between the artery and vein, into a bag, as in a common spurious aneurism, and so make a sort of canal between these two vessels. The trunk of the vein will then be removed to some distance from the trunk of the artery, and the bag will be situated chiefly upon the underside of the vein. The bag may take on an irregular form, from the cellular membrane being more loose and yielding, at one place, than at another, and from being unequally bound down by the fascia of the biceps muscle. And if the bag be very large, especially, if it be of an irregular figure, no doubt, coagulations of blood may be formed, as in the common spurious aneurism."

As Scarpa correctly observes, a concurrence of two circumstances is requisite for the production of an aneurismal varix: 1. the incision in the vein, and that in the artery, must be exactly in the same direction: 2. the solution of continuity in the integuments and upper side of the vein must heal, while the wound in the deeper side of that vessel, and the puncture in the upper surface of the artery, remain open, and communicate so readily, that the arterial blood finds greater facility in entering from the artery into the vein, than in being effused from the artery into the surrounding cellular substance.

If one of these two circumstances be wanting, either because the wounding instrument has entered the artery a little obliquely

from the vein, or because the vein has not been sufficiently near to the artery, on account of the cellular substance between them, the arterial blood most frequently does not produce the aneurismal varix; or, if it does, the disease is always complicated with effusion of arterial blood into the cellular substance, or with an aneurism, and aneurismal varix at the same time. In this case, the small aneurismal sac serves as a short canal of communication between the artery and the vein, (*Med. Facts and Obs. Vol. 4, p. 115.*) two distinct diseases in fact being formed from the same cause, and placed one over the other, viz., an aneurism, and an aneurismal varix. (*Scarpa, p. 421, Ed. 2.*) The following marks of distinction, between aneurism and aneurismal varix, are pointed out by the same author: the aneurismal varix forms always a circumscribed tumour; aneurism does not always do so. The cellular substance, which constitutes the sac of the aneurism, does not always resist so strongly the impetus of the arterial blood, as the coats of the vein do. Not unfrequently, therefore, aneurism, from being circumscribed at first, becomes diffused; extends along the course of the wounded artery; compresses strongly the surrounding parts; occasions acute pain and inflammation; and the parts are threatened with gangrene. On the contrary, the aneurismal varix is always circumscribed, increases very slowly, does not produce much pain, and, as it augments, it always extends more or less above and below the place, where venesection has been done; and this extension is in proportion to the greater or less force, with which the arterial blood is thrown from the artery into the vein, and the greater or less resistance made by the valves, situated in the vein below the puncture; and according to the greater or less number of veins, communicating with the aneurismal varix. The seat of the disease is generally the basilic vein, which appears dilated in an unusual manner, forming an oblong tumour, of the size of a walnut, if the disease is recent. In the centre of the swelling is the cicatrix left by the lancet. The vein is less dilated, the further it is from this scar, and, in general, at the distance of two inches and a half above and below this point, the vessel resumes its natural size. The small tumour, as has been explained, pulsates like an artery, with a tremulous motion and hissing noise, which is sometimes so great, that the patient cannot sleep, if he is lying with his head low, and resting on the injured arm. The trunk of the brachial artery, from the axilla down to the place where it has been wounded with the lancet, vibrates with extraordinary force. There is no change of colour, nor inflammation of the skin; and the pain is inconsiderable. The swelling is compressible and yielding; but, it returns as soon as the pressure is removed from it. When the arm is kept for some time raised up towards the head, the tumour diminishes, and the same thing happens, when pressure is made on the communication be

tween the artery and vein, or when a tight tourniquet is applied near the axilla. If the disease be complicated with aneurism, a second pulsating tumour will be found lying under the aneurismal varix. (Scarpa, p. 424, Ed. 2.)

After relating two cases, illustrative of the nature of aneurismal varix, Dr. W. Hunter proceeds to inquire; "Why is the pulse at the wrist so much weaker in the diseased arm, than in the other? surely, the reason is obvious and clear. If the blood can easily escape from the trunk of the artery directly into the trunk of the vein, it is natural to think, that it will be driven along the extreme branches with less force, and in less quantity.

"Whence is it, that the artery is enlarged all the way down the arm? I am of opinion, that it is the consequence of the blood passing so readily from the artery into the vein, and is such an extension, as happens to all arteries, in growing bodies, and to the arteries of particular parts, when the parts themselves increase in their bulk, and, at the same time, retain a vascular structure. It is well known, that the arteries of the uterus grow much larger in the time of utero-gestation. I once saw a fleshy tumour upon the top of a man's head, as large nearly as his head; and his temporal and occipital arteries, which fed the tumour, were enlarged in proportion. I have observed the same change in the arteries of enlarged spleens, testes, &c. so that I should suppose it will be found to be universally true in fact, and the reason of it in theory seems evident." (See *Med. Obs. and Inq.* V. 2.)

In thin subjects, the median basilic vein is so close to the brachial artery, the track of which it crosses at a very acute angle, that it is almost impossible to open it at this point, without risk of wounding the artery at the same time. The bend of the arm, indeed, is the very situation in which this disease is usually noticed. It is easy to conceive, however, that a venous aneurism may happen wherever an artery of a certain diameter lies immediately under a large vein. Thus, Baron Larrey informs us, that his uncle, surgeon to the hospital at Toulouse, saw a case of aneurismal varix, which had been occasioned by a wound of the popliteal vein and artery, and that a history of the disease accompanied with the pathological preparation, was sent to the former royal academy of surgery at Paris. "The varicose swelling, which was as large as two fists, occupied the whole of the ham in a middle-aged man, who some years previously had been wounded with a sword in that part of the limb. At a consultation, amputation was deemed necessary, and was performed with success. At the bottom of the varicose pouch, the communication between the popliteal vein and artery was observed. The sac itself was evidently composed of the vein, the parts of which, adjacent to the varicose swelling, were dilated, especially the lower continua-

tion of the vessel. The popliteal nerve was rendered flat, like a piece of tape, and adherent to the outside of the cyst. (See *Mem. de Chir. Mil.* T. 4, p. 340. *Boyer, Traité des Maladies Chirurgicales*, &c. T. 2, p. 177.) Two cases are likewise recorded by Mr. Hodgson. In one the disease was caused in the thigh, about four inches below Poupart's ligament, by the point of a heated iron rod, which had passed through the femoral artery and vein. In the other example, the aneurismal varix was situated in the ham, and was the consequence of a wound in that part with a pistol ball. (*Treatise on the Disease of Arteries*, p. 498.) Larrey records one example of aneurismal varix situated under the clavicle.

P. Cadrieux was wounded with a sabre in a duel, on the 20th of November, 1811: part of the attachment of the sterno-mastoid muscle was divided, the anterior scalenus, the subclavian artery and vein at a very deep point, and probably also a portion of the brachial plexus. A most violent hemorrhage took place, followed by syncope. Pressure was applied to the wound, and the patient conveyed to the hospital at Gros-Caillou. The external wound, which was small, did not bleed at all the following morning; but the clavicle was quite concealed by a large tumour, which throbbed with the arteries, particularly at its lower part. A peculiar noise, like that of the passage of a fluid through tortuous metallic tubes, could also be felt more deeply, in the direction of the axillary vein. The arm was quite cold, insensible, motionless, and without any pulse, even in the axillary artery itself. On the 22d, the tumour was not larger, but its throbbings were stronger; the jugular vein on the same side was considerably dilated; and the pulsation of the carotid, and of the arteries of the opposite arm, had augmented. A vein in the right arm was opened, and compresses dipped in camphorated vinegar, muriate of ammonia, and ice, applied to the swelling. It would be superfluous here to detail the diet, bleedings, and other parts of the treatment. On the 8th day, the outer wound was quite healed. On the 10th, the veins of the limb were observed to be swelled, and sensibility and warmth were returning in it; though no pulse could yet be felt. The tumour was much smaller, and restricted to a circumscribed place behind the great pectoral muscle; but, the hissing sound was still plainer. By degrees, the muscles of the arm and fore-arm regained their power of motion. The hand, however, continued useless, and affected with pricking pains. On the 20th day, the tumour was quite gone, but the hissing sound was unaltered, and the throbbings were still evident in the veins of the neck and arm. The arm was not at all emaciated. On the 55th day, a pulse at the wrist could be slightly felt; the hissing sound had become less distinct; the veins were less turgid; and their throbbing diminished.

A second instance of aneurismal varix,

or rather perhaps of a varix, of all the veins of the arm, caused by a sword wound of the axilla, is also recorded by Larrey. He mentions, however, that a pulsation was observable in the most prominent of the enlarged vessels. (See *Mem. de Chir. Mil. T. 4, p. 341, &c.*)

Dr. Dorsey, of Philadelphia, has published a case of aneurismal varix, which is in several respects interesting. A patient was wounded in the leg with buck-shot; and, after the cure of the injury, an aneurismal varix was noticed just below the knee; and, in a little time, the superficial veins of the limb became dilated, and the hissing noise, characterizing this species of aneurism, could be plainly distinguished. The patient was seen by Dr. Dorsey, twelve years after the accident; the veins were then considerably distended from the toes up to the groin, all about which latter part pain was constantly experienced, and some ulcers situated on the foot and ankle could not be healed by any of the remedies, which were tried. The patient was under the care of Dr. Physick and Wistar. The enormous distention of the vessels of the leg, and the uncertainty of finding out the communication between the artery and vein, led these gentlemen to tie the first of these vessels in the middle of the thigh. Gangrene soon ensued, and in this state, the patient was further weakened by an unexpected hemorrhage from one of the distended veins; and though the vessel was secured with a ligature, the bleeding recurred, the patient became more and more enfeebled, and at length expired. When the limb was examined after death, the whole of the trunk of the femoral artery was found preternaturally dilated; while all the veins of the limb were considerably distended; a bougie could readily be passed from the popliteal into the posterior tibial artery, which participated in the dilatation, and from this last artery, the instrument could be passed into the vein, through a cyst, situated on the inside of the leg below the knee. (See *Dorsey's Elements of Surgery, Vol. 2. p. 210, Philadelphia, 1813.*)

Professor Scarpa, Dr. Hunter, Mr. B. Bell, Pott, and Garneri, mention cases of the aneurismal varix, which remained stationary for fourteen, twenty, and thirty-five years. Several cases are related by Brambilla, Guattani, and Monteggia, of a cure having obtained by means of compression. But, as this method of cure, if it does not succeed, exposes the patient to the danger of a complication of the disease with an aneurism, it ought not to be employed, except in recent cases, where the tumour is small, and in slender patients, at an early period of life, and where both of the vessels can be compressed accurately against the bone.

Two cases are recorded, in which it was necessary to operate in consequence of the disease being joined with aneurism of the artery, and even bursting. The sacs were opened, and a ligature applied both

above and below the aperture in the artery. (See *Medical Facts and Obs. Vol. 4, p. 111, and Medical Museum, Vol. 1. p. 65.*)

In the winter of 1819, I heard a case read to the Medical and Chirurgical Society, of London, from Mr. Atkinson, of York, who had found it necessary to take up the brachial artery, on account of the large and increasing size of an aneurismal varix: mortification of the limb ensued. When the aneurism, joined with an aneurismal varix, is circumscribed, but the circumstances such as to require the brachial artery to be tied, this vessel should be exposed, and tied above the swelling with a single ligature. It is only when the aneurism is diffused, that opening the swelling, and applying a ligature both above and below the aperture in the artery, are thought necessary. (See *Scarpa on Aneurism, p. 433, Ed. 2.*)

ANEURISM FROM ANASTOMOSIS.

This is the term which the late Mr. John Bell, of Edinburgh, applied to a species of aneurism, which resembles such bloody tumours, (*navi materni*) as appear in newborn children, grow to a large size, and ultimately bursting, emit a considerable quantity of blood.

Clear descriptions of this disease may be traced in writers, though before the publication of Mr. John Bell's Principles of Surgery, it was not classed with aneurisms. Thus, Desault has recorded a case of this affection, for the express purpose of proving, that pulsation is an uncertain sign of the existence of an aneurism. (See *Parisian Chirurgical Journal, Vol. 2, p. 73.*)

The aneurism from anastomosis often affects adults, increasing from an appearance like that of a mere speck, or pimple, to a formidable disease, and being composed of a mutual enlargement of the smaller arteries and veins. The disease originates from some accidental cause; is marked by a perpetual throbbing; grows slowly, but uncontrollably; and is rather irritated, than checked by compression. The throbbing is at first indistinct, but when the tumour is perfectly formed, the pulsation is very manifest. Every exertion makes the throbbing more evident. The occasional turgid states of the tumour produce sacs of blood in the cellular substance, or dilated veins, and these sacs form little, tender, livid, very thin, points, which burst, from time to time, and then like other aneurisms, this one bleeds so profusely, as to induce extreme weakness.

The tumour is a congeries of active vessels, and the cellular substance, through which these vessels are expanded, resembles, as Mr. John Bell describes, the gills of a turkey cock, or the substance of the placenta, spleen, or womb. The irritated and incessant action of the arteries fills the cells with blood, and from these cells, it is reabsorbed by the veins. The size of the swelling is increased by exercise, drinking, emotions of the mind, and by all causes, which accelerate the circulation.

In this peculiar disease, Dupuytren regards the arteries as being in an aneurismal state, but besides this circumstance, he says, their extreme ramifications intermix in a thousand different ways, intercepting spaces, and representing cavities, like those which are found in the corpora cavernosa; and he imputes the disease to increased activity of the capillary circulation. (*Fr. Transl. of Mr. Hodgson's Work, T. 2, p. 300.*)

In the female subject, the hemorrhage from the aneurism by anastomosis sometimes is a substitute for menstruation, as the following example illustrates: And Vachot, of St. Maury, in Bresse, was born with a tumour on her chin, of the size and shape of a small strawberry, without pain, heat, or discoloration of the skin. As it produced no uneasiness, nor inconvenience whatever, it excited little attention, particularly as it did not seem to increase with the growth of the child. For the first fifteen years, there was but little alteration; but about the menstrual period, it increased suddenly to double the size, and became more elongated in its form. A quantity of red blood was observed to ooze from its extremity. This flux became, in some measure, periodical, and sometimes was sufficiently abundant to produce an alarming degree of weakness. Each period of its return was preceded by a violent pain in the head and numbness.

Before and after the appearance of these symptoms, there was no alteration in the size of the tumour; the only difference was a small enlargement of the cutaneous veins, with an increase of heat in the part, occasioning some degree of tenderness.

The menses at length took place, but, in small quantity, and, at irregular periods, without influencing the blood discharged from the tumour, or the frequency of the evacuation.

The breasts were not enlarged till a late period, nor did the approach of puberty seem to have its accustomed influence on those glands, &c. (*See Parisian Chirurgi- cal Journal, Vol. 2, p. 73, 74.*)

As far as my observations extend, the true aneurism by anastomosis, is a disease with which a surgeon should never tamper; and, if it be decided to try any treatment at all, the only prudent plan is either a complete removal of the disease with a knife, or tying the chief arteries, which supply the swelling with blood. The first is the surest mode of relief, and should be preferred, when not forbidden by the magnitude, or situation of the tumour.

In performing such an operation, as Mr. Wardrop remarks, the surgeon should avoid cutting into the substance of the tumour; for if this be done, the hemorrhage is violent; whereas, by making the incisions beyond the diseased structure, the flow of blood is much more moderate, (*Med. Chir. Trans. Vol. 9, p. 212.*) In a few navi pressure may be safely tried; but, all attempts to get rid of a true aneurism by anastomosis,

by caustic, I should think by no means advisable.

"This aneurism, as Mr. John Bell observes, is a mere congeries of active vessels, which will not be cured by opening it; all attempts to obliterate the disease with caustics, after a simple incision, have proved unsuccessful, nor does the interception of particular vessels, which lead to it, affect the tumour; the whole group of vessels must be extirpated. In varicose veins, or in aneurisms of individual arteries, or in extravasations of blood, such as that produced under the scalp from blows upon the temporal artery, or in those aneurisms, produced in school-boys by pulling the hair, and, also, in those bloody effusions from blows on the head, which have a distinct pulsation, the process of cutting up the varix, aneurism, or extravasation, enables you to obliterate the vessel and perform an easy cure. But, in this enlargement of innumerable small vessels, in this aneurism by anastomosis, the rule is, not to cut into, but to cut it out.' These purple and ill-looking tumours, because they are large, beating, painful, covered with scabs, and bleeding, like a cancer in the last stage of ulceration, have been but too often pronounced cancers! incurable bleeding cancers! and the remarks, which I have made, while they tend, in some measure, to explain the nature and consequences of the disease, will remind you of various unhappy cases, where either partial incisions only had been practised, or the patient left entirely to his fate. (*Principles of Surgery, Vol. 1.*)

The following case, recorded by Mr. Wardrop, affords a valuable illustration of the nature and structure of one form of this disease. A child was born with a very large subcutaneous nœvus on the back part of the neck. It was of the form and size of half an ordinary orange. The tumour had been daily increasing, and, when Mr. Wardrop saw it, ten days after birth, the skin had given way, and a profuse hemorrhage had taken place. The swelling was very soft and compressible: squeezed in the hand, it yielded like a sponge, and was reducible to one third of its original size. On removing the pressure, however, the tumour rapidly filled again, and the skin resumed its purple colour. "Conceiving the immediate extirpation of the tumour the only chance of saving the infant, (says Mr. Wardrop,) I removed it as expeditiously as possible, and made the incision of the integuments, beyond the boundary of the tumour; aware of the danger of hemorrhage where such tumours are cut into. So profuse, however, was the bleeding, that, though the whole mass was easily removed by a few incisions, the child expired.

"The tumour having been injected, by throwing coloured size into a few of the larger vessels, its intimate structure could be accurately examined. Several of the vessels, which, from the thinness of their coats, appeared to be veins, were of a large

size, and there was one sufficiently big to admit a full-sized bougie." This vessel was fully as large as the carotid artery of an infant. The boundaries of the tumour appeared distinct, some healthy cellular membrane surrounding it, which was traversed by the blood vessels. On tracing these vessels to the diseased mass, they penetrated into a spongy structure, composed of numerous cells and canals, of a variety of forms and sizes, all of which were filled with the injection, and communicated directly with the ramifications of the vessels. These cells and canals had a smooth and polished surface, and, in some parts, resembled very much the cavities of the heart, fibres crossing them in various directions, like the columnæ tendineæ. The opening in the skin, through which the blood had escaped during life, communicated directly with one of the large cells, into which the largest vessel also passed. (*Wardrop in Med. Chir. Trans. Vol. 9. p. 203.*)

In the section on carotid aneurisms, I have mentioned the cases, in which Mr. Travers and Mr. Dalrymple cured aneurisms by anastomosis in the orbit, by tying the common carotid artery. These facts prove, that aneurism by anastomosis, like many other diseases, sometimes admits of being cured, on the principle of cutting off, or lessening the supply of blood to the part affected.

However, surgeons must not be too confident of being always able to cure the disease, by tying the main artery, from which the swelling receives its supply of blood; and the great cause of failure is the impossibility of preventing in some situations the transmission of a considerable quantity of blood into the tumour, through the anastomosing vessels. In fact, every vessel, artery, and vein, around the disease, seems to be enlarged and turgid; and the inosculation is so infinite, that no point of the circumference of the swelling can be imagined, which is free from them. Etienne Dumand was born with two small red marks on the antihelix of the right ear. Until the age of twelve years, the chief inconveniences were a sensation of itching about the part, occasional bleeding from it, and the greater size of this, than of the other ear. The disease now extended itself over the whole antihelix, and to the helix and concha; and the upper part of the ear became twice as large as natural. Slight alternate dilatations and contractions began to be perceptible in the tumour, which was of a violent colour, and covered by very thin skin. Soon afterwards, any accidental motion of the patient's hat, was sufficient to excite copious hemorrhages, which were difficult to suppress, and at the same time, that they produced great weakness, caused a temporary diminution of the tumour and its pulsations. At length, the disease began to raise up the scalp for the distance of an inch around the meatus auditorius, and the hemorrhages to be more frequent and alarming. Pressure was next applied to the temporal, auricular and oc-

cipital arteries; but, as the patient could not endure it, the two first of these vessels were tied, the only benefit from which was a slight diminution in the pulsation and bulk of the swelling. This treatment did not prevent the return of hemorrhage, and, therefore, forty-three days after the first operation, a ligature was applied to the occipital artery, which proceeding was equally ineffectual. As the disease continued to make progress, the patient entered the Hotel-Dieu, where, on the 8th of April, 1818, Dupuytren tried what effect tying the trunk of the carotid artery would produce on the swelling. As soon as the ligature was applied, the throbbings ceased, and the tumour underwent a quick and considerable diminution. On the 17th day, slight expansions and contractions of the diseased part of the ear were again perceptible, though the swelling had diminished one third. An attempt was now made to compress the tumour by covering it with plaster of Paris: a plan which was somewhat painful, though it lessened the size of the disease. After being sixty-three days in the hospital, the patient was discharged, at which period, the tumour was diminished one third; the throbbings had returned; but, no unpleasant noises continued to affect the ear. (*See Breschet's Tr. of Mr. Hodgson's Work, T. 2, p. 296.*)

An infant, six weeks old, was brought to Mr. Wardrop, on account of an aneurism by anastomosis, (a subcutaneous nœvus) of a very unusual size, situated on the left cheek. The base of the tumour extended from the temple to beyond the angle of the jaw, completely enveloping the cartilage of the ear. At its upper part, there was an ulcer, about three inches in diameter, presenting a sloughing appearance. The tumour was soft and doughy; its size could be much diminished by pressure; there was a throbbing in it; and a strong pulsation in the adjacent vessels. The disease was daily increasing, and several profuse hemorrhages had taken place from the ulcerated part. Mr. Wardrop, knowing from the case, to which I have already adverted, the danger of attempting to extirpate so large a tumour of this nature, was led to try what benefit might be obtained by tying the carotid artery. A few hours after this operation, the tumour became soft and pliable, its purple colour disappeared, and the tortuous veins collapsed. On the second day, the skin had resumed its natural pale colour, and the ulceration continued to extend. On the third, the tumour still diminished. On the fourth, the swelling had considerably increased again; the integuments covering it had become livid; and the veins turgid. The inosculating branches of the temporal and occipital arteries had become greatly enlarged. A small quantity of blood had oozed from the ulcer. After remaining without much alteration, the tumour on the seventh day had again evidently diminished. On the ninth the ulceration was extending itself slowly, and the tumour was lessened fully one half. On the twelfth the child's health was mate-

rially improving. The auricular portion of the swelling had now so much diminished, that the cartilage of the ear had fallen into its natural situation. After a poultice had been applied for two days, the central portion of the swelling, which appeared like a mass of hardened blood, was softened, and Mr. Wardrop removed considerable portions of it. On the thirteenth, the child became very ill, and died the following day, exhausted by the irritation of an ulcer, which had involved the whole surface of an enormous tumour. Mr. Wardrop thinks the advantages likely to occur from the plan of tying the main arteries, supplying tumours of this nature with blood, are the diminution of the size of the disease; the lessening of the danger of hemorrhage, if the ulcerative process has commenced; and the rendering it practicable to remove the swelling with the knife, though the operation may previously have been dangerous, or impracticable. (See *Med. Chir. Trans. Vol. 9. p. 206-214, &c.*) Instead of endeavouring to promote ulceration in any of these cases, my own sentiments would incline me to leave the business of removing the diseased mass quietly to the absorbents, or, at most, I would only assist them with pressure, or by covering the tumour with plaster of Paris.

The next case of aneurism by anastomosis, which I shall briefly notice, was one which was under the care of my friend Mr. Lawrence, and situated on the right finger of the right hand, in a young woman about twenty years of age. The disease was attended with painful sensations extending to various parts of the limb and the breast, and the arm was disqualified for any kind of exertion. In January 1815, Mr. Hodgson had taken up the radial and ulnar arteries, and the consequences of the operation were an entire cessation of beating, collapse of the swelling, and relief from pain; but, these symptoms all recurred in a few days. Finding compression unavailing, and the sufferings of the patient increasing, Mr. Lawrence proposed amputation of the finger at the metacarpal joint: but, as this suggestion was not approved of, he recommended the patient to try the effects of a division of all the soft parts, by a circular incision close to the palm, so as to cut off the supply of blood. This operation Mr. Lawrence performed in the presence of Mr. George Young and myself, in as complete a manner as can possibly be conceived. All the soft parts, excepting the flexor tendons, with their theca and the extensor-tendon, were divided. The digital artery, which had pulsated so evidently in the palm of the hand, was fully equal in size to the radial, or ulnar of an adult, and was the principal nutrient vessel of the disease. After tying this and the opposite one, we were surprised at finding so strong a jet of arterial blood from the other orifices of these two vessels, as to render ligatures necessary. I can here only add, that the whole finger beyond the cut swelled very considerably;

the incision healed slowly; the swelling subsided, but did not entirely disappear; the integuments recovered their natural colour; the pulsation and pain were removed; and the patient so far recovered the use of her arm, that she could work at her needle for an hour together, and use the arm for most purposes. (See *Wardrop's Obs. on one species of Nævus in Med. Chir. Trans. Vol. 9, p. 216.*)

For information on aneurism, consult *G. Arnaud on Aneurisms*, 8vo. S. C. Lucæ, *De Ossescentia Arteriarum Senili*, 4to. Marburgi, 1817. *A. F. Walther, Programma de Aneurysmate*, Argent., 1738. (*Haller Disp. Chir. 5, 189.*) *A. de Haller, De Aortæ Venæque Cavæ gravioribus quibusdam Morbis Observationes*, 4to. Gott. 1749. *F. Thierry, Quæstio, &c. An tutior faciliorque vulgari detur Aneurysmatis Chirurgica curatio?* (*Haller, Disp. Chir. 5, 211.*) *H. Petiati de Aneurysmate*, Monsp. 1749. *Lauth Scriptorum Latinorum de Aneurysmatibus Collectio*, 4to. Argent., 1785, which work contains *Asman's Diss. de Aneurysmate*, 1773, *Guattani, de Externis Aneurysmatibus*, 4to. Romæ, 1772; *Lancisi de Aneurysmatibus*, Argent. 1785; *Matani de Aneurysmaticis Præcordiorum Morbis Animadversiones*, 1785; *Verbrugge, Dissertatio Anatomico Chirurgica de Aneurysmate*, 1773; *Wellinus de Aneurysmate Vero Pectoris Externo Hemiplegiæ Sobole*, Basil., 1750; *Murray, Observationes in Aneurysmata Femoris*, 1781; *Trew, Aneurysmatis Spuri post Venæ Basilicæ Sectionem Orti, Historia et Curatio*. See also an account of Mr. Hunter's Method of performing the Operation for the cure of the Popliteal Aneurism, by Sir E. Home, in *Trans. of a Society for the Improvement of Med. and Chir. Knowledge*, V. 1, p. 138, and V. 2, p. 235. *Sabatier's Médecine Opératoire*, T. 3, V. 2. The several volumes of the *Medico-Chirurgical Transactions. Cases in Surgery*, by J. Warner, p. 141, &c. Edit. 4. *J. B. Heraud, De Aneurysmatibus Externis*, Monsp. 1775. *J. F. L. Deschamps, Obs. et Reflexions sur la Ligature des principales Artères blessées, et particulièrement sur l'Aneurisme de l'Artere poplitee*, 8vo, Paris, 1797. *Richerand's Nosographie Chirurgicale*, T. 4. Ed. 4. *Pelletan's Clinique Chirurgicale*, T. 1, et 2. *A. Burns's Surgical Anatomy of the Head and Neck* 8vo. Edinb. 1811, and *Observations on the Diseases of the Heart*, &c. 8vo. Edinb. 1809. *Ramsden's Practical Observations on the Sclerocele*, with four cases of operations for aneurism, 8vo. Lond. 1811. *Œuvres Chirurgicales de Desault par Bichat*, T. 2, p. 553. *S. C. Lucæ quædam Observationes Anatomica circa Nervos Arterias adjuvantes et comitantes*, 4to. Francof. 1810. *Wells in Transactions of a Society for the Improvement of Med. and Chir. Knowledge*, V. 3, p. 81-85, &c. *G. P. Scheid, Obs. Med. Chir. de Aneurysmate*, 8vo. Hardervici, 1792. *Corvisart, Essai sur les Maladies et les Lésions Organiques du Cœur et des Gros Vaisseaux*. Edit. 2, or Transl. by C. H. Hebb; 8vo. Lond. 1813. *C. Bell's Operative Surgery*, V. 1. Ed. 2. *John Bell's Principles of Surgery*,

V. 1. *Richter's Anfangsgr. der Wundarzneey-kunst*, B. 1. *Abernethy's Surgical Works*, V. 1. *Monro's Observ. in the Edinb. Med. Essays*. Various productions in the *Med. Observ. and Inquiries*. The article *Aneurism* in *Rees's Cyclopædia*. J. P. *Mauvoir Mémoires Physiologiques et Pratiques sur l'Aneurisme et la ligature*, 8vo. Geneva, 1802. *Freer's Observations on Aneurism*, 4to. Lond. 1807; and a *Treatise on the Anatomy, Pathology, and Surgical Treatment of Aneurism* by A. Scarpa, translated by J. H. Wishart, 1808. The original Italian was published 1804. *Ant. Scarpa, Memoria sulla Ligatura delle Principali Arterie delle Arti, con una Appendice all' Opera sull' Aneurisma*. fol. Pavia, 1817. This tract, and a great deal of valuable additional matter, are contained in the 2d Edition of Scarpa's Work on Aneurism by Mr. Wishart, 8vo. Edinb. 1819. *Callisen's Systema Chirurgiæ Hodiernæ*, Part 2, p. 545, &c. Edit. 1798. *Boyer's Traité des Maladies Chir.* T. 2, p. 84, &c. A. C. *Hutchison, Letter on Popliteal Aneurism*, 8vo. Lond. 1811. *Hodgson on the Diseases of Arteries and Veins*, London, 1815, a work of the greatest accuracy and merit. Transl. into German by Dr. Koberwein, with additions by this gentleman, and Dr. Kreysig, 8vo. Hannover, 1817; and also Transl. into French, with valuable annotations by Breschet, 2 Tomes, 8vo. Paris, 1819. *Roux, Nouveaux Elémens de Médecine Opératoire*, T. 1. Also *Roux, Voyage fait à Londres en 1814, ou Parallele de la Chirurgie Anglaise avec la Chirurgie Française*, p. 248, &c. Paris, 1815. D. *Fried. Lud. Kreysig, Die Krankheiten des Herzens*. 4 Bände, 8vo. Berlin, 1814—17. C. D. *Kühn, De Aneurysmate Externo*, 4to. Jenæ, 1816. A. J. *Risethueber, Mem. sur la Ligature et l'Applatissement de l'Artère, dans l'Operation de l'Aneurisme Poplite*, 8vo. A. V. *Berlinghieri Memoria sopra l'Allacciatura dell' Arterie*, 8vo. Pisa, 1819. *Lassus Pathologie Chir.* T. 1, p. 347, &c. *Leveillé Nouvelle Doctrine Chirurgicale*, T. 4, p. 213, &c. T. F. *Baltz, De Ophthalmia Catarrhali Bellica*, &c.; *Præmittitur F. C. Nægele Epistola, quæ Historia et Descriptio Aneurysmatidis, quod in Aorta abdominali observavit*, 4to. Heidelberg, 1816. J. *Cole, Exposé du Traitement d'un Aneurisme inguinal par la Ligature de l'Artère Iliaque Externe*, 8vo. Cambrai, 1817; and *London Medical Repository for May, 1820*. *Hennen's Military Surgery*, p. 183—185, 393, &c. Ed. 2, Edinb. 1820. J. *Kirby, Cases*, &c. 8vo. Lond. 1819. C. *Fred. Hubner de Aneurysmatibus*; Gott. 1807. *Manuale di Chirurgia del Cav. Assalini*; Milano, 1812. The author's main object is to recommend his compressor. C. F. *Gräfe, Angiektasie, ein Beitrag zur rationellen Cur und Erkenntniss der Gefäss-ausdehnungen*. This appears to me to be a valuable work, on account of the great many facts and interesting cases, to which it refers. I can here only mention a few things, which are noticed in it. *Waltner* found five small calculi in the veins of the bladder. *Stenzal* met with a fatty tumour, as large as a hen's egg, in the curvature of the aorta, and several smaller swellings of the same kind in the descending part

of that vessel. The patient's symptoms had been great anxiety, difficulty of breathing, and palpitations. *Baillie's* case of obliteration of the vena cava, and consequent dilatation of the vena azygos, is noticed. *Baader* describes an aneurism of the pulmonary artery, accompanied with a dilatation of the aorta. *Beuland* mentions a varix of the vena cava, which caused a difficulty of swallowing by its pressure on the oesophagus. *Sandifort* saw an aneurism of the coronary vessels of the heart. The author records the case of a woman, who died in *Jacob's Hospital* at Leipzig, of a scirrhus hardness of the brain. She had been for some time previously afflicted with amaurosis. After the fat had been separated from the eye-ball, several oblong roundish prominences, equal in size to a small lentil, appeared through the sclerótica. They arose from the subjacent veins. When the optic nerve was cut through, the central artery was found dilated to the size of a piece of straw. Several vessels of the choroides were varicose, and the retina converted into a beautiful scarlet net work. *Malacarne* saw aneurisms of the dura mater, as large as a pigeon's egg, arising from several branches of the spinous artery. *Sir Gilbert Blane* noticed aneurisms of both the internal carotids at the sides of the sella turcica. Varices of the pia mater and plexus chorioides are also recorded. All the rest of this work merits perusal.

ANTHRAX, (ανθραξ, a burning coal.) See Carbuncle.

ANTIMONIAL POWDER; PULVIS ANTIMONIALIS. In all cases, where it is desirable to promote the secretions in general, and those of the kidneys, skin, and alimentary canal, in particular, it is proper to have recourse to antimonial medicines. In inflammation of the brain and its membranes, and, in every instance, in which there exists an inflammation of a viscus of high importance in the system, antimony should be exhibited, and, in general, the antimonial powder is as eligible a prescription as any. For an adult, from two to five grains may be ordered, and the dose, if requisite, may be repeated, three or four times a day. In order to increase its action on the bowels, it is frequently conjoined with calomel in the form of pills.

ANTIMONIUM MURIATUM. This has often been named, *butter of antimony*, and is employed in surgery as a caustic.

ANTIMONIUM TARTARIZATUM, (Emetic Tartar.) This medicine is well known as the most common emetic. For this purpose, it may be given in either of the following ways, as the indications of the case may demand. R. *Antimonii Tart.* gr. ij. Aq. distil. ℥iv. Misce et cola. Dosis ℥ij. pro emetico; vel ℥ss quadrante quoque horæ, donec supervenerit vomitus. If tartarised antimony be exhibited merely to excite a diaphoresis, half an ounce, or one table spoonful, of the above mixture is to be given once every six hours.

ANTRUM, Diseases of. This cavity is

liable to a variety of diseases. Sometimes its membranous lining inflames, and secretes an extraordinary quantity of mucus, or pus; at other times, in consequence of inflammation, or other causes; it is the seat of various excrescences, polypi, and fungi. Even the bony parietes of the antrum are occasionally affected with exostosis, or caries. Sometimes it contains extraneous bodies; and, it is even asserted, that insects may be generated there, and cause, for many years, very afflicting pains.

COLLECTIONS OF MUCUS AND PUS.

Inflammation of the membranous lining of the antrum sometimes produces an extraordinary secretion of mucus within that cavity, and the collected fluid being confined, the bony parietes of the cavity become expanded in a surprising degree. This disease, says Boyer, is sometimes ascribed to a blow on the cheek, to caries of the teeth, or the projection of one of their fangs into the antrum. But, in general, the case takes place unpreceded by any of these causes, and without there being the least ground for suspecting what has given rise to the disorder. It is remarked, however, that collections of mucus within the antrum are most frequent in young subjects: of three patients, seen by Boyer, the eldest was not more than twenty. (*Traité des Mal. Chir. T. 6, p. 139.*) Whether the obliteration of the duct leading to the nose be a cause or only an effect of the disease, is, as Mr. Hunter observes, not easily determined; but, from some of the symptoms there is great reason to suppose it an attendant. "If it be a cause, we may suppose, that the natural mucus of these cavities, accumulating, irritates, and produces inflammation for its own exit; in the same manner, as an obstruction to the passage of the tears through the ductus ad nasum produces an abscess of the lachrymal sac." (See *Hunter's Natural Hist. of the Teeth, p. 174, Ed. 3.*) The most interesting example of the effects of the lodgment of mucus in the antrum is that recorded by Dubois: a boy, between seven and eight years of age, was observed to have at the base of the ascending process of the upper jaw bone, on the left side, a small, very hard tumour, of the size of a nut. As it gave no pain, and did not appear to increase, his parents did not give themselves any concern about it. When he was about sixteen, however, the swelling began to increase, and to be somewhat painful. Before he was eighteen, its augmentation was so considerable, that the floor of the orbit was raised up by it: the eye thrust upwards: the palpebræ very much closed; the arch of the palate pushed down in the form of a tumour; and the nostril almost effaced. Below the orbit, the cheek made a considerable prominence; while the nose was thrown towards the opposite side of the face, and the skin at the upper part of the tumour, below the lower eyelid, was of a purple red colour, and threatening to burst.

The upper lip was drawn upwards, and behind it, all the gums on the left side were observed to project much further, than those on the opposite side of the face, and at this point alone the thinness of the bony parietes of the antrum was perceptible. The patient spoke, and breathed with great difficulty; he slept uneasily, and his mastication was painful. The case was at first supposed by Dubois, Sabatier, Pelletan, and Boyer, to be a fungus of the antrum, and an operation was considered advisable. In proceeding to this measure, the first thing, which attracted the notice of Dubois, was a sort of fluctuation in the situation of the gum, behind the upper lip; a circumstance which led him to give up the idea of the case being a fungus, though he expected that, on making an opening merely a small quantity of ichorous matter would escape, affording no kind of information. In this place, however, he determined to make an incision, along the alveolar process, whereby a large quantity of a glutinous substance, like lymph, or what is found in cases of ranula, was discharged. A probe was now introduced, with which Dubois could feel a cavity equal in extent to the forepart of the tumour, and in moving the instrument about, with the view of learning, whether any fungus was present, it struck against a hard substance, which felt like one of the incisor teeth, near the opening that had been made. Five days after this first operation, Dubois extracted two incisors and one grinder, and then removed the corresponding part of the alveolar process. As the hemorrhage was profuse, the wound was now filled with dressings, which in two days came away, and enabled Dubois to see with facility all the interior of the cavity. At its upper part, he perceived a white speck, which he supposed was pus, but on touching it with a probe, it turned out to be a tooth, which was then extracted, in doing which some force was requisite. The rest of the treatment merely consisted in injecting lotions into the cavity, and applying common dressings. In about six weeks, all the hollow disappeared; but the swelling of the cheek, and palate, and the displacement of the nose, still continued. In the course of another year and a half, however, every vestige of deformity was entirely removed. (*Dubois, Bulletin de la Faculté de Med. No. 8.*)

With respect to the treatment of collections of mucus in the antrum, by means of injections, thrown into that cavity through the natural opening in it, while the head is inclined to the opposite side, for the purpose of facilitating the escape of the collected fluid, as proposed by Jourdain in 1765. (*Mem. de l'Acad. de Chir. T. 4, p. 357.*) Deschamps and Boyer are of opinion, that the method is objectionable, not only because it is difficult to find the aperture, which, ere the disease forms an outward swelling, is probably obliterated, but also because the thickness of the mucus collected would make it impossible for the surgeon

to wash it out with injections. Hence, Boyer approves of the practice of opening the tumour in an eligible place, and to an extent sufficient for the discharge of the mucus. (*Deschamps, Traite des Maladies des Fosses Nasales, et de leurs Sinus*, p. 231, *Svo. Par.* 1804; *Boyer Traite des Mal. Chir.* T. 6, p. 146, *Svo. Paris*, 1818.) Indeed, that Jourdain's proposal was attended with too much difficulty for common practice, was the sentence long ago pronounced upon it by a committee of the Royal Academy of Surgeons in France, nominated for the express purpose of inquiring into the merits of the suggestion. The method of making an opening into the antrum, will be considered in the sequel of this article. As a general rule, I may here remark, that except where there is a tumour, or fungus to be extirpated, or a foreign body to be extracted from the antrum, it is quite unnecessary to remove any part of the alveolar process, or cut away any of the bony parietes of the antrum, the drawing of one of the teeth situated below this cavity, and making a perforation in this situation, being the only kind of opening required. This aperture may be preserved as long as necessary by the introduction of a piece of elastic gum catheter, which is to be fastened to the adjacent teeth, and through which the secretion in the antrum may escape, or lotions be injected. (See *Deschamps Traite des Mal. des Fosses Nasales, &c.* p. 234.) However, as Hunter remarks, if the forepart of the bone has been destroyed, even though the case be merely a collection of mucus, or pus, an opening may be made on the inside of the lip; but, on account of the difficulty of maintaining such an aperture, he still inclines to the practice of drawing one of the teeth. (*Natural Hist. of the Teeth*, p. 176, ed. 3.)

Of all the above cases, abscesses are by far the most common. Violent blows on the cheek, inflammatory affections of the adjacent parts, and especially, of the pituitary membrane lining the nostrils, exposure to cold and damp, and, above all things, bad teeth, may bring on inflammation and suppuration within the hollow of the upper jaw bone. The first symptom is a sensation of pain, at first imagined to be a toothach, particularly if there should be a carious tooth at this part of the jaw. Such pain, however, extends more into the nose, than that usually does, which arises from a decayed tooth: it also affects, more or less, the eye, the orbit, and the situation of the frontal sinuses. (See *Hunter on the Teeth*, p. 176, ed. 3.) But, even these symptoms are insufficient to characterize the disease, the nature of which is not unequivocally evinced, till a much later period. The complaint is, in general, of much longer duration, than one entirely dependent on a caries of a tooth, and its violence increases more and more, until, at last, a hard tumour is perceptible below the cheek bone. By degrees the swelling extends over the whole cheek: but it afterwards rises to a point,

and forms a very circumscribed hardness, which may be felt above the back grinders. This symptom is accompanied with redness, and sometimes with inflammation and suppuration of the external parts. It is not uncommon, also, for the outward abscess to communicate with that within the antrum.

The circumscribed elevation of the tumour, however, does not occur in all cases. There are instances in which the matter makes its way towards the palate, causing the bones of this part to swell, and, at length, rendering them carious, unless timely assistance be given. There are other cases, in which the matter escapes between the fangs and sockets of the teeth. Lastly, there are certain examples, in which the matter formed in the antrum, makes its exit at the nostril of the same side, when the patient is lying with his head on the opposite one, in a low position. If this mode of evacuation should be frequently repeated, it prevents the tumour, both from pointing externally, and bursting, as it would do if the purulent matter could find no other vent. But this evacuation of pus from the nostril is not very common; for, according to Mr. Hunter, the opening between the antrum and cavity of the nose, is generally stopped up. This celebrated anatomist even seems inclined to think, as I have already observed, that the disease may sometimes be occasioned by the impervious state of this opening, in consequence of which obstruction, the natural mucus of the antrum may collect there in such quantity, as to irritate and inflame the membrane, with which it is in contact, just like as an obstruction in the ductus nasalis hinders the passage of the tears into the nose, and causes an abscess in the lachrymal sac. This is a point, however, on which even Mr. Hunter would not venture to speak with certainty; for it is by no means impossible that the impervious state of the opening is rather an effect than the cause of the disease, since inflammation in the antrum is often manifestly produced by causes of a different kind, and since the opening in question is not invariably closed.

Abscesses in the antrum require a free exit for their contents, and, if the surgeon neglects to procure such opening, the bones become more and more distended and pushed out, and, finally, carious. When this happens, the pus makes its appearance, either towards the orbit, the alveoli, the palate, or, as is mostly the case, towards the cheek. The matter having thus made a way for its escape, the disease now becomes fistulous.

In all cases, whether the pus be simply confined in the antrum, or whether the case be conjoined with a carious affection of the bones, the principal indication is to discharge the matter.

The ancients seem to have known very little about the treatment of diseases of the antrum. Drake, an English anatomist, is reputed to be the first proposer of a plan

for curing abscesses of this cavity, (*Anthropologia Nova*. London, 1727.) Meibomius, however, a long while before him, had proposed, with the same intention, the extraction of one or more of the teeth, in order that the matter might find an opening for its escape, through the sockets. This plan may be employed with success. The pus frequently has a tendency to make its way outward towards the teeth; it often affects their fangs; and, after their extraction, the whole of the abscess is seen to escape through the sockets. But this very simple plan will not suffice for all cases, as there are numerous instances, in which there is no communication between the alveoli and the antrum.

Drake, and, perhaps, before him, Cowper, took notice of the insufficiency of Meibomius's method, and, hence, they proposed making a perforation through the socket into the antrum with an awl, for the purpose of letting out the matter, and injecting into the cavity such fluids as were judged proper.

The extraction of one or more teeth, and the perforation of the alveoli, being essential steps in treating diseases of the antrum, we must consider what tooth ought to be taken out in preference to others.

A caries, or even a mere continual aching, of any particular tooth, in general ought to decide the choice. But, if all the teeth should be sound, which is not often the case, writers direct us to tap each of them gently, and to extract the one which gives most pain on this being done. When no information can be thus obtained, other circumstances ought to guide us.

All the grinding teeth, except the first, correspond with the antrum. They even sometimes extend into this cavity, and the fangs are only covered with the pituitary membrane. The bony lamella, which separates the antrum from the alveoli, is very thin, towards the back part of the upper jaw. Hence, when the choice is in our power, it is best to extract the third or fourth grinder, as, in this situation, the alveoli can be more easily perforated. Though, in general, the first grinder and canine tooth do not communicate with the antrum, their fangs approach the side of it, and from their socket an opening may readily be extended into that cavity.

When one or more teeth are carious, they should be removed, because they are both useless and hurtful. The matter frequently makes its escape, as soon as a tooth is extracted, in consequence of the fang having extended into the antrum, or rather in consequence of its bringing away with it a piece of the thin partition between it and the sinus. Perhaps a discharge may follow from the partition itself being carious. If the opening, thus produced, be sufficiently large to allow the matter to escape, the operation is already completed. But, as it can easily be enlarged, it ought always to be so when there is the least suspicion of its being too small. However, when no pus makes its appearance, after a tooth is ex-

tracted, the antrum must be opened by introducing a pointed instrument in the direction of the alveoli. Some use a small trocar, or awl; others a gimblet for this purpose.

The patient should sit on the ground, in a strong light, resting his head on the surgeon's knee, who is to sit behind him. Immediately the instrument has reached the cavity, it is to be withdrawn. Its entrance into the antrum is easily known by the cessation of resistance. After the matter is discharged, surgeons advise the opening to be closed with a wooden stopper, in order to prevent the entrance of extraneous substances.

The stopper is to be taken out, several times a day, to allow the pus to escape. This plan soon disposes the parts affected to discontinue the suppuration, and resume their natural state. Sometimes, however, the pus continues to be discharged, for a long time after the operation, without any change occurring, in regard to its quality or quantity. In such instances, the cure may often be accelerated by employing injections of brandy and water, lime-water, or a solution of the sulphate of zinc.

Some surgeons prefer a silver cannula, or a piece of elastic gum catheter, instead of the stopper, as it can always be left pervious except at meals. The examples recorded, in which the extraction of a tooth, and the perforation of the bottom of the antrum, have been the means of curing abscesses in that cavity, are very numerous. (See *Farmer's Select Cases*, No. 9; *Gooch's Cases*, p. 63, new edition; *Palfyn Anatomie*, &c.)

If no opening were made in the antrum, the matter would make its way, sometimes towards the front of this cavity, which is very thin; sometimes towards the mouth; and fistulous openings, and caries would inevitably follow.

When the bones are diseased, the above plan will not accomplish a cure, until the affected pieces of bone exfoliate. A probe will generally enable us to detect any caries in the antrum. The fetid smell, and ichorous appearance of the discharge, also leave little doubt that the bones are diseased; and, in proportion as the bones free themselves of any dead portions, the discharge has less smell, and its consistence becomes thicker.

When there are loose pieces of dead bone, or other foreign bodies, to be extracted, it is requisite to make a larger opening in the antrum, than can be obtained at its lower part. Instances also occur, where patients have lost all the grinding teeth, and the sockets are quite obliterated, so that a perforation from below cannot be effected. Some practitioners object to sacrificing a sound tooth. In these circumstances, it has been advised to make a perforation in the antrum, above the alveolar processes: Lamorier first proposed this method. It consists in making a transverse incision, below the malar process, and above the root

of the third grinder. Thus the gum and periosteum are divided, and the bone exposed. A perforating instrument is to be conveyed into the middle of this incision, and the opening in the antrum made as large as requisite. (See *Mem. de l'Acad. de Chir. T. 4, p. 351, and Gooch's Obs. append. p. 138.*) There are some extensive exfoliations of the antrum, where it is absolutely necessary to expose a great part of the surface of the bone, and to cut away the dead pieces which are wedged, as it were, in the living ones. A small trephine may sometimes be advantageously applied to the malar process of the superior maxillary bone.

Surgeons formerly treated carious affections of the antrum in the most absurd and unscientific way, introducing setons through its cavity, and even having recourse to the actual cautery. The moderns, however, are not much inclined to adopt this sort of practice. It is now known, that the detachment of a dead portion of bone, in other terms, the process of exfoliation, is nearly, if not entirely, the work of nature, in which the surgeon can at most act only a very inferior part. Indeed, he should limit his interference to preventing the lodgment of matter, maintaining strict cleanliness, and removing the dead pieces of bone, as soon as they become loose. But, it is to be understood, that there are occasional examples, in which the dead portions of bone are so tedious of separation, and so wedged in the substance of the surrounding living bone, that an attempt may properly be made to cut them away.

TUMOURS OF THE ANTRUM.

Ruysch, Bordenave, Desault, Abernethy, Weinhold, and others, have recorded cases of polypous, fungous, and cancerous diseases of the antrum, and examples of this cavity being affected with exostosis.

The indolence of any ordinary fleshy tumour in the antrum, while in an incipient state, certainly tends to conceal its existence; but such a disease rarely occurs without being accompanied with some affection of the neighbouring parts; and hence, its presence may generally be ascertained before it has attained such a size as to have altered in a serious degree the natural shape of the antrum. This information may be acquired, by examining whether any of the teeth have become loose, or have spontaneously fallen out; whether the alveolar processes are sound, and whether there are any fungous excrescences making their appearance at the sockets, whether there is any habitual bleeding from one side of the nose; any sarcomatous tumour at the side of the nostril, or towards the great angle of the eye. When the swelling, however, has attained a certain size, the bony parietes of the antrum always protrude, unless the body of the tumour should be situated in the nostril, and only its root in the antrum. This case, however, is very uncommon.

As soon as a tumour is certainly known to exist in the antrum, the front part of this

cavity should be opened; without waiting till the disease makes further progress. In a few instances, indeed, we may avail ourselves of the opening, which is sometimes found in the alveolar process, and enlarge it sufficiently to allow the tumour to be extirpated. If the front of the antrum were freely opened, it would in general be better to cut away the disease in its interior.

A swelling of the parietes of the antrum, in consequence of an abscess, or a sarcomatous tumour in its cavity, may lead us to suppose the case an enlargement of the bones, or an exostosis. The symptoms of the two first affections have been already detailed. One sign of an exostosis, besides the absence of the symptoms characterizing an abscess or a sarcoma, is the thickened parietes of the antrum forming a solid resistance; whereas, in cases of mere expansion, the dimensions of the surface of the bone being increased, while its substance is rendered proportionally thinner, the resistance is not so considerable.

When such an exostosis depends upon a particular constitutional cause, and especially upon one of a venereal nature, it must be attacked by remedies suited to this affection. But when the disease resists internal remedies, and its magnitude is likely to produce an aggravation of the case, a portion of the bone may be removed with a trephine, or a cutting instrument. Such operations, however, require a great deal of delicacy and prudence.

Mr. B. Bell, vol. 4, describes a kind of exostosis of the upper jaw, very different from what I have mentioned, since instead of its being distinguishable from other diseases of the antrum by the greater firmness of the tumour, the substance of the bone gradually acquires such suppleness and elasticity, that it yields to the pressure of the fingers, and immediately resumes its former plumpness when the pressure is discontinued. If the bone be cut, it is found to be as soft as cartilage, and, in an advanced stage of the disease, its consistence is almost gelatinous. The swelling increases gradually, and extends equally over the whole cheek, without becoming prominent at any particular point, or only so in the latter periods of the malady, when the soft parts inflame, and become affected. The complaint is described as totally incurable. Cutting and trephining the tumour, as recommended in other cases of exostosis, only aggravate the patient's unhappy condition.

Mr. Abernethy has related an account of a very singular disease of the antrum. The patient, who was thirty-four years of age, when the account was written, perceived, when about ten years old, a small tumour on his left cheek, which gradually attained the size of a walnut, and then remained for some time stationary. About a year afterwards, the tumour having again enlarged, a caustic was applied to the integuments, so as to expose the bone. The actual cautery was next applied, and an opening thus made into the antrum. After the exfoliation, the

antrum became filled with a fungus, which rose out upon the cheek, and could not be restrained by any applications. Part of the fungus also made its way into the mouth, through the socket of the second tricuspid tooth, the other teeth remaining natural. The disease continued in this state nine years, occasionally bleeding in an alarming way. When the patient was in his twentieth year, the whole fungus sloughed away during a fever, and never returned. After this, the sides of the aperture in the bone began to grow outwards, forming an exostosis, which rapidly attained to a great magnitude. A small exostosis took place in the mouth, but became no larger than a horse-bean. The exostosis of the maxillary bone was of an irregular figure, and projected from the whole circumference of the aperture a great way directly forward. Mr. Abernethy compared its appearance, when he was writing, with that of a large teacup fastened upon the face, the bottom of which may be supposed to communicate with the antrum. The diameter of the cup, formed by the circular edge of the bone, was three inches and a half; the depth two inches and seven-eighths. The general height of the sides of the exostosis, from the basis of the face, was two inches; its walls were not thick, and terminated in a thin circular edge. The integuments, as they approached this edge became thinner, and they extended over the edge into the cavity. The exostosis now reached to the nose in front, and to the masseter muscle behind; above it included the very ridge of the orbit, and below it grew from the edge of the alveolar process. A line that would have separated the diseased from the sound bone would have included the orbit and nose, and indeed one half of the face. Mr. Abernethy saw no means of affording the man relief. (*Trans. of a Society for the Improvement of Med. and Chirurgical Knowledge*, vol. 2.) See also a case related by Harrison. (*New Lond. Med. Journ.* vol. i. p. 1.)

In a case of fungus, which had distended the antrum, hindered the tears from passing down into the nose, raised the lower part of the orbit, caused a protrusion of the eye, made two of the grinding teeth fall out, and occasioned a carious opening in the front of the antrum, through which opening a piece of the fungus projected, Desault operated as follows: the cheek was first detached from the os maxillare, by dividing the internal membrane of the mouth, at the place where it is reflected over this bone. Thus the outer surface of the bone was denuded of all the soft parts. A sharp perforating instrument was applied to the middle of this surface, and an opening made more forward than the one already existing. The plate of bone, situated between the two apertures, was removed with a little falciform knife, which, being directed from behind forward, made the division without difficulty. The opening thus obtained being insufficient, Desault endeavoured to enlarge

it below, by sacrificing the alveolar process. This he endeavoured to accomplish with the same instrument, but finding the resistance too great, he had recourse to a gouge and mallet. A considerable piece of the alveolar arch was thus detached, without any previous extraction of the corresponding teeth, three of which were removed by the same stroke. In this manner an opening was procured in the external and inferior part of the antrum, large enough to admit a walnut. Through this aperture a considerable part of the tumour was cut away with a knife, curved sideways, and fixed in its handle. A most profuse hemorrhage took place; but, Desault, unalarmed, held a compress in the antrum, for a short time; this being removed, the actual cautery was applied repeatedly to the rest of the fungus. The cavity was dressed with lint, dipped in powdered colophony.

On the eighteenth day, the swelling was evidently diminished, the eye less prominent, and the epiphora less visible. But, at this period, a portion of fungus made its appearance again. This was almost entirely destroyed by applying the actual cautery twice. It appeared again, however, on the twenty-fifth day, and required a third and last recourse to the cautery. From this time, the progress of the cure went on rapidly. Instead of fungous excrescences, healthy granulations were now formed in the bottom of the sinus. The parietes of the antrum, gradually approaching each other, the large opening made in the operation was obliterated, and reduced to a small aperture, hardly large enough to admit a probe. Even this little opening was closed in the fourth month, at which time no vestiges of the disease remained, except the loss of teeth, and a very obvious depression just where they were situated.

In all fungous diseases of the antrum, making a free exposure of them is an essential part of the treatment; if you neglect this method, how can you inform yourself of the size, form, and extent of the tumour? How could you remove the whole of the fungus, through a small opening, which would only allow you to see a very little portion of the excrescence? How could you be certain that the disease were extirpated to its very root? Even when the antrum is freely opened, this circumstance can only be learnt with difficulty; and how could it be ascertained, when only a point of the cavity is opened? A portion, left behind, very soon gives origin to a fresh fungus, the progress of which is more rapid, and the character more fatal, in consequence of being irritated by the surgical measures adopted. (*Œuvres Chirurgicales de Desault, par Bichat*, t. 2.) See also other cases, recorded by Canolles, (*Réveil Périodique de la Soc. de Méd. t. 2. No. 9.*) Eichorn, (*Diss. de Polypis in Antro Highmori*, Goett. 1814.) Sandifort, (*Museum Anat. vol. 2. Tab. 30.*) Leveillé, (*Réveil de la Soc. &c. t. 1. p. 24.*)

Weinhold, (*Von den Krankheiten der Gesichtsknochen*, p. 27. 4to. Halle, 1818.)

I imagine, that English surgeons, unaccustomed to use the actual cautery, will peruse with a degree of aversion this means, so commonly employed in France by Desault, and other celebrated surgeons. Nor can I expect, that they will altogether approve the use of the mallet and gouge, for making a free opening into the antrum. Perhaps, it might be better to trephine this cavity with a small instrument for the purpose, and then cut the fungus away. After removing as much of it as possible in this manner, some instrument of suitable shape might be used to scrape the part, where the tumour has its root. However, if there be any case in which potent and violent measures, like those of Desault, are allowable, it is the one of which we have just been treating. Inveterate diseases demand powerful means, and tampering with them is generally more hurtful than useful.

There is an interesting case of a fungus in the maxillary sinus, related in the first volume of the Parisian Chirurgical Journal. It was at last cured by opening the antrum, applying the cautery, and tying the portion of the tumour which had made its way into the nose. In the second volume of the same work, is an excellent case, exhibiting the dreadful ravages which the disease may produce when left to itself.

INSECTS IN THE ANTRUM.

It is said, that insects in this cavity may sometimes make an opening into it necessary. This case, however, must be exceedingly rare; and even what we find in authors (*Pallas de insectis viventibus intra viventia*) appears so little authentic, that I should hardly have mentioned the circumstance, if there were not, in a modern work, (*Med. Comm. vol. 1.*) a fact, which appears entitled to attention. Mr. Heysham, a medical practitioner at Carlisle, relates, that a strong woman, aged sixty, in the habit of taking a great deal of snuff, was subject, for several years, to acute pains in the antrum, extending over one side of the head. These pains never entirely ceased, but were more severe in winter than summer, and were always subject to frequent periodical exacerbations. The patient had taken several anodyne medicines, and others, without benefit, and had twice undergone a course of mercury, by which her complaints had been increased. All her teeth on the affected side had been drawn. At length, it was determined to open the antrum with a large trocar, though there were no symptoms of an abscess, nor of any other disease in this cavity. For four days, no benefit resulted from this operation. During this space, bark injections, and the elixir of aloes, were introduced into the sinus. On the fifth day, a dead insect was extracted, by means of a pair of forceps, from the mouth of the cavity. It was more than an inch long, and thicker

than a common quill. The patient now experienced relief for several hours: but the pains afterwards recurred with as much severity as before; oil was next injected into the antrum, and two other insects, similar to the former, were extracted. No others appeared, and the wound closed. The pains were not completely removed, but they were considerably diminished for several months, at the end of which time they became worse than ever, particularly affecting the situation of the frontal sinus.

Bordenave has published, in the twelfth and thirteenth volumes of the *Mem. de l'Acad. de Chir. edit. 12mo.* two excellent papers on the diseases of the antrum. In the thirteenth volume, he relates the history of a case, in which several small whitish worms, together with a piece of fetid fungus, were discharged from the antrum, after an opening had been made on account of an abscess of this cavity, attended with caries. (P. 381.) But, in this instance, the worms had probably been generated after the opening had been made in the cavity; for when they made their appearance, the opening had existed nine months. Deschamps refers to another case, in which M. Fortassin, his colleague at La Charité, found in the antrum of a soldier, whom he was dissecting, a worm of the *ascaris lumbricus* kind, which was four inches in length. (*Traité des Mal. des Fosses Nazales, &c. p. 307.*) Such an example is also recorded in one of the volumes of the *Journ. de Med.* Were a case of this description to present itself in a living subject, it would be advisable to inject oil into the cavity of the antrum, and then endeavour to wash out the extraneous substances by throwing into the sinus warm water by means of a syringe. See *Précis d'Observations sur les Maladies du Sinus Maxillaire, par M. Bordenave, in Mem. de l'Acad. Royale de Chirurgie, t. 12. edit. in 12mo.* Also *Suite d'Observations on the same Subject, by M. Bordenave, t. 13, of the said Work.* L. H. Runge, *De Morbis Præcipuis Sinuum Ossis Frontis et Maxillæ Superioris, &c. Rintelii, 1760.* - Haller, *Disp. Chir. 1. 205.* *L'Encyclopédie Méthodique, Partie Chirurgicale, art. Antre Maxillaire. Jourdain, in Mém. de l'Acad. de Chir. t. 4. p. 357;* also his *Traité des Dépôts dans le Sinus Maxillaire, &c. 12mo. Paris, 1760;* his *Traité des Mal. de la Bouche, t. 2;* and *Journ. de Méd. t. 21. p. 57, et t. 27. p. 52—157.* This author, who, in 1765, suggested to the Royal Academy of Surgery the method of injecting fluid into the antrum, through the natural opening, is said to have been anticipated in the practice by Allouel, who first thought of the plan in 1737, and tried it with success in 1739; See Boyer, *Traité des Mal. Chir. t. 6. p. 149.* *Rémarques et Observations sur les Maladies du Sinus Maxillaire, in Œuvres Chirurgicales de Desault par Bichat, t. 2. p. 156.* *Desault's Parisian Chirurgical Journal, vol. 1. and 2.* *Medical Communications, vol. 1.* *Trans. of a Society for the Improvement of Med. and Chir. Knowledge, Vol. 2. Natural History of the Human*

Human Teeth, by John Hunter, p. 174, 175. edit. 3 Gooch's *Chirurgical Works*, vol. 2. p. 61. and vol. 3. p. 161. edit. 1792. Callisen's *Systema Chirurgiæ Hodiernæ*, t. 1. p. 346, &c. Dubois, in *Bulletin de la Faculté de Médecine*, N. 8. J. L. Deschamps *Traité des Maladies des Fosses Nazales, et de leur Sinus*, 8vo. Paris, 1804. P. V. Leinicker, *De Sinu Maxillari, ejusdem Morbis*, &c. Wurceb. 1809. C. A. Weinhold, *Ideen über die abnormen Metamorphosen der Highmorshöhle*, Leipz. 1810. C. A. Weinhold, *Von den Krankheiten der Gesichtsknochen und ihrer Schleimhäute, der Ansammlung eines grossen Polypen in der linken Oberkieferhöhle, dem Verhuten der Einsinkens der Gichtischen und Venerischen Nase, und der Einsetzung Künstlicher Choanen*, 4to. Halle, 1818.

ANUS. The lower termination of the great intestine, named the rectum, is so called, and its office is to form an outlet for the feces.

The anus is furnished with muscles, which are peculiar to it, viz. the sphincter, which keeps it habitually closed, and the *levatorius ani*, which serve to draw it up into its natural situation, after the expulsion of the feces. It is also surrounded, as well as the whole of the neighbouring intestine, with muscular fibres, and a very loose sort of cellular substance. It is subject to various diseases, in which the aid of surgery is requisite: of these we shall next treat.

IMPERFORATE ANUS.

This complaint is sometimes met with, though not very often. As it is of the utmost consequence that this and other malformations should not remain long unknown, one of the earliest duties of an accoucheur, after delivery, should be an examination of all the natural outlets of new-born infants.

Such an inspection sometimes evinces, that the place in which the extremity of the rectum, or the anus, ought to be, is entirely, or partly, shut up by a membrane, or fleshy adhesion. In other instances, no vestige of the intestine can be found, as the skin retains its natural colour over the whole space between the parts of generation and the os coccygis, without being more elevated in one place than another. In these cases, the intestine sometimes terminates in one or two culs de sac, about an inch upward from the ordinary situation of the anus. (See *Baillie's Series of Engravings*, Fasc. 4. Tab. 5.) Sometimes it does not descend lower than the upper part of the sacrum; sometimes it opens into the bladder, or vagina. Dr. Palmer dissected a case, where the colon, after reaching the vicinity of the left kidney, begun, as it descended, to form a sigmoid flexure; but, previously to its arrival at the concavity of the left ilium, made a sudden turn to the right; and crossing the psoas muscle, reached the projection of the sacrum, where it terminated, *without at all entering the pelvis*. With this malformation was combined an imperforate meatus

urinarius, and some considerable deviations of the genital organs from their natural structure. (See *Medico-Chir. Journ.* vol. 1. p. 180. 8vo. Lond. 1816.)

Sometimes the colon terminates in a sac, and the rectum is entirely deficient (See *Beauregard*, in *Journ. de Med.* t. 66.) Instances are also upon record, where the rectum opened into the urethra. (*Bresl. Samml.* 1718, p. 702; *Hist. d'l'Acad. Royale des Sciences.* 1752; p. 113; *Hochstetter*, in *Med. Wochenblatt*, 1780, No. 18—1783. No. 19; *Kretschmar*, in *Horn's Archiv.* 1 B. p. 350.)

When a surgeon is consulted, he must not lose much time in deliberation; for, if a speedy opening be not made for the feces, the infant will certainly very soon perish, with symptoms similar to those of a strangulated hernia. After ascertaining the complaint, which is an easy matter, he should endeavour to learn, whether the anus is merely shut by a membrane, or fleshy adhesion, or whether the anus is altogether wanting, in consequence of the lower portion of the cavity of the gut being obliterated, or the rectum not extending sufficiently far down.

When a membrane, or production of the skin closes the opening of the rectum, the part producing the obstruction is somewhat different in colour from the neighbouring integuments. It is usually of a purple or livid hue, in consequence of the accumulation of the meconium on its inner surface. The meconium, propelled downward by the viscera above, forms a small roundish prominence, which yields like dough to the pressure of the fingers; but immediately projects again when the pressure is removed. When a fleshy adhesion closes the intestine, the circumstance is obvious to the eye, if the part protrude, which is generally the case. The finger feels greater hardness and resistance than when there is a mere membrane, and the livid colour of the meconium cannot be seen through the obstructing substance.

These last signs alone are enough to convince the surgeon of the necessity of the operation; but they do not clearly show, whether the intestine descends as far as it ought, in order to form a proper kind of anus. Complete information on this point, can only be acquired after the membrane or adhesion has been divided; or else after the child's death, when the operation has proved ineffectual. Though there be no mark to denote where the anus ought to be situated, and no degree of prominence, yielding, like soft dough, to the pressure of the fingers, and rising again when such pressure is removed; yet it may happen, especially on our being consulted immediately after the child is born, that, notwithstanding the absence of such symptoms, denoting the presence of the meconium, and the natural extent of the intestine, as far as where the anus ought to be, the gut may exist, and have a cavity, as far as the membrane, or adhesion, closing it.

When the anus is simply covered with

skin, and its place pointed out by a prominence, arising from the contents of the rectum, we have only to make an opening with a knife, sufficient to let out the meconium. Levret recommends making a circular incision in the membrane; but a transverse cut is sufficient. A small tent of lint is afterwards to be introduced, in order to keep the opening from closing. If the anus should only be partly closed by a membrane, the opening may be dilated with a tent; but, if the aperture should be very small, it is preferable to use the bistoury for its enlargement.

When no external appearance denotes where the situation of the anus ought to be, the case is much more serious and embarrassing; and this, whether the intestine is stopped up by a fleshy adhesion, or the coalescence of its sides, or whether a part of the gut is wanting.

However, it is the surgeon's duty to do every thing in his power to afford relief. For this purpose an incision, an inch long, is to be made in the situation where the anus ought to be, and the wound is to be carried more and more deeply in the natural direction of the rectum. The cuts are not to be made directly upwards, nor in the axis of the pelvis, for the vagina, or bladder, might thus be wounded. On the contrary, the operator should cut backward, along the concavity of the os coccygis, where there is no danger of wounding any part of importance. In all cases of this kind, the surgeon's finger is the best director. The operator, guided by the index finger of his left hand, introduced within the os coccygis, is to dissect in the direction above recommended, until he reaches the feces, or has cut as far as he can reach with his finger. If he should fail in finding the meconium, as death must unavoidably follow, one more attempt ought to be made, by introducing, upon the finger, a long trocar, in such a direction as seems best calculated for finding the rectum.

By the prudent adoption of such proceedings, many infants have been preserved, which would otherwise have been devoted to certain death. Hildanus, La Motte, Roonhuysen, and several others, have successfully adopted the above practice. Mr. B. Bell informs us, that he saw two of these cases, in which the intestine was very distant from the integuments, and in which he was so successful as to form an anus, which fulfilled its office tolerably well for several years; but he found it exceeding difficult to keep the passage sufficiently large and pervious. As soon as he removed the dossils of lint, and other kinds of tents, used for maintaining the necessary dilatation, such a degree of contraction speedily followed, that the evacuation of the intestinal matter became very difficult, for a long while afterwards. He employed, at different times, tents made of sponge, gentian root, and other substances, which swell on being moistened. But these always produced so much pain and irritation, that it

was impossible to persevere in their use. After remarking such inconveniences, he condemns the use of tents. He is of opinion, that whoever makes trial of them upon parts, as sensible as the rectum, will soon find, that the advice to use them is wrong.

Tents, made of very soft lint, dipped in oil, or rolls of bougie plaster, cause less irritation than those composed of any other materials.

Though keeping the opening dilated may seem simple and easy, to such men as have had no opportunities of seeing cases of this description, it is far otherwise in practice. Mr. B. Bell assures us, that he never met with any disease which gave him so much trouble and embarrassment as he experienced in the two cases of this sort, which occurred in his practice. Although in both instances he at first made the openings sufficiently large, it was only by very assiduous attention, for eight or ten months, that the necessity for another operation, and even repeated operations, was prevented. When only the skin has been divided, the rest of the treatment is doubtless more simple; for, then, nothing more is requisite than keeping a piece of lint, for a few days, in the opening made with the knife. But, when the extremity of the rectum is at a certain distance, though we may generally hope to effect a cure, after having succeeded in giving vent to the intestinal matter; yet the treatment, after the operation, will always demand, for a long while, a great deal of attention and care on the part of the surgeon. The difficulty of success may be considered as, in some measure, proportioned to the depth of the necessary incision. In a case, like that recorded by Dr. Palmer, to which I have above adverted, the inutilty of any attempt to discharge the feces by an operation, in the usual site of the anus, must be sufficiently obvious. (*Medico-Chir Journ. Vol. I. p. 181.*)

Sometimes, while the anus appears pervious and well-formed, infants suffer the same symptoms, as if there were no anus at all. The reason of this depends upon the intestine being occasionally closed by a membranous partition, situated more or less upward, above the aperture of the anus. (*Courtiat, Nouvelles Obs. sur les Os. p. 147.*) and sometimes the symptoms are owing to the termination of the gut in a cul-de-sac. This erroneous formation may always be suspected, when an infant, whose anus is externally open, does not void any excrement, for two or three days after its birth, and, especially, when urgent symptoms arise, such as swelling of the belly, vomiting, &c. We are now to endeavour to ascertain, whether the rectum is impervious above the anus, by attempting to inject clysters, or to introduce a probe. If the gut be shut up, there is nothing to be done, but having recourse to the method described above, and forming a communication by means of a bistoury guided on the finger, or else with a pharyngotomus. If the ob-

stacle should only consist of a transverse membrane, the operation will be easy, and its success almost certain. But, if there should be a strangulation, or obstruction of the intestine, the case is infinitely more serious. However, as the operation is the only resource for saving the child's life, we ought not to hesitate about performing it.

When the anus is imperforate, the intestine sometimes opens into the vagina, or bladder. (*Dumas in Recueil Periodique de la Soc. de Med. T. 3, N. 13. L'Ereille Rapport des Travaux de la Soc. Philom. Vol. 1, p. 145. Murray Diss. Arresis ani vesicæ, Ups. 1794. Act. Nat. Cur. Vol. 8, Obs. 24, Ups. Vol. 9, Obs. 11, Roestel in Mursinna's Journ. für die Chir. 1, B. p. 547. Obs. Med. Decad. 2, No. 2.*) The first of these cases is the least dangerous of all the malformations of this sort. The intestine may also open and terminate at two places, at the same time, viz. at the usual place, so as to form a proper anus, more or less perfect; and also in the vagina.

If these two openings should be ample enough, for the easy evacuation of the excrement, nothing can be done at so tender an age; for, though voiding the feces through the vagina, is a most unpleasant inconvenience, yet, there is no effectual means of closing the opening of the intestine in this situation, nor could one be devised, which would not seriously incommode the infant.

But, when the two openings are exceedingly small, and the alvine evacuations cannot readily pass out, even with the aid of clysters, the opening of the anus ought to be dilated by cannulæ of different sizes. If this method should not avail, the knife must be employed, and the wound dressed, as already explained.

For the most part, the intestine has only one opening in the vagina. In this circumstance, as in the instance in which the feces have no vent at all, we must make an incision in that place, which the anus ought to occupy. The natural course of the feces being opened by this operation, which in such a case is not at all perilous, much less excrement will pass out of the vagina, and, of course, the infirmity will be diminished. By the introduction of a tube into the new anus, the communication between the rectum and vagina, might possibly be obliterated, and a perfect cure accomplished. The opening between the intestine and vagina, may, also, be too small for the easy evacuation of the feces, and even expose the infant to the same sort of dangerous symptoms, as it would be subject to, if the rectum had positively no opening at all.

In male infants, the rectum sometimes opens into the bladder, and, in this circumstance, there is generally no anus. The case is easily known by the meconium being blended with the urine, which acquires a thick greenish appearance, and is voided almost continually, though in small quantities. Only the most fluid part of the meconium is thus discharged. The thicker part

not getting from the rectum into the bladder, nor from the bladder into the urethra, greatly distends the intestines and bladder, and produces the same symptoms as take place in cases of total imperforation. Hence, without the speedy interference of art to form an anus, capable of giving vent to the feces, with which the urinary organs cannot remain obstructed, the infant will inevitably die. This case must, therefore, be treated like the foregoing examples. Though we can hardly hope to prevent altogether the inconveniences, resulting from the rectum opening into the bladder, since even a new passage will not completely hinder the feces from following the other course; yet we shall thus afford the child a very good chance of preservation, and the only one which its situation will allow.

In cases, in which we cannot procure an outlet for the feces, by any of the methods pointed out above, it has been proposed by M. Littre, to make an opening above one of the groins, find out a portion of intestine, open it, fix it in this situation with a few stitches, and thus form an artificial anus. M. Sabatier was only acquainted with one case, in which this proceeding had been actually done, viz. the example where M. Duret, a French naval surgeon operated. This gentleman cut into the abdomen at the lower part of the left iliac region, and having opened the sigmoid flexure of the colon, he fixed it near the wound. The child was saved by the formation of an artificial anus; but at the age of twenty-five months, it continued to be troubled with a sort of prolapsus of the lining of the bowel. (*See Recueil Periodique de la Soc. de Med. T. 4, No. 19, & Sabatier, Med. Operatoire, T. 3, p. 336, Edit. 2.*)

Callisen conceives, that the descending colon may be most conveniently got at by making an incision in the left lumbar region, along the edge of the quadratus lumborum muscle, and he prefers this mode of operating, to that of making the incision above the groin. (*Syst. Chir. Hodiernæ, T. 2, p. 688, 689.*) Its advantages, however, are not obvious, and certainly it is on some accounts objectionable. (*See Médecine Operatoire par Sabatier, Tom. 3, p. 330. Also Remarques sur Differens Vices de Conformation, que les Enfants apportent en naissant, par M. Petit, in Mem. de l'Acad. Royale de Chirurgie, Tom. 2, p. 236, Edit. in 12mo. H. A. Wrisberg, de præternaturali et raro intestini Recti cum vesica urinaria coælitu, et inde pendente ani defectu, 4to. Gott. 1779. Ford, in Med. Facts and Obs. Vol. 1, No. 10, Chamberlaine in Memoirs of the Med Soc. of Lond. Vol. 5, No. 23. Richerand's Nosographie Chirurgicale, Tom. 3, p. 437, &c. Edit. 5. Callisen's Systema Chirurgiæ Hodiernæ, T. 2, p. 686, Edit. 1800; &c.*)

ABSCESSES OF THE ANUS.—FISTULA IN ANO.

The custom of giving the appellation of fistula to every collection of matter formed

near the anus; has, by conveying a false notion of them, been productive of such methods of treating them, as are diametrically opposite to those which ought to be pursued.

A small orifice or outlet from a large or deep cavity, discharging a thin gleet, or sanies, made a considerable part of the idea, which our ancestors had of a fistulous sore, wherever seated. With the term fistulous, they always connected a notion of callosity: and, therefore, whenever they found such a kind of opening yielding such sort of discharge, and attended with any degree of induration, they called the complaint a *fistula*. Imagining this callosity to be a diseased alteration made in the very structure of the parts, they had no conception that it could be cured by any means, but by removal with a cutting instrument, or by destruction with escharotics: and, therefore, they immediately attacked it with knife or caustic, in order to accomplish one of these ends; and very terrible work they often made.

That abscesses, formed near the fundament, do sometimes, from bad habits, from extreme neglect, or from gross mistreatment, become fistulous, is certain; but the majority of them have not, at first, any one character or mark of a true fistula; nor can, without the most supine neglect on the side of the patient, or the most ignorant management on the part of the surgeon, degenerate, or be converted into one.

Collections of matter from inflammation (wherever formed) if they be not opened in time, and in a proper manner, do often burst. The hole, through which the matter finds vent, is generally small, and not often situated in the most convenient, or most dependent part of the tumour: it therefore is unfit for the discharge of all the contents of the abscess; and, instead of closing, contracts itself to a smaller size, and becoming hard at its edges, continues to drain off what is furnished by the undigested sides of the cavity.

When an abscess about the anus bursts, the smallness of the accidental orifice; the hardness of its edges; its being found to be the outlet from a deep cavity; the daily discharge of a thin, gleet, discoloured kind of matter; and the induration of the parts round about, have all contributed to raise, and confirm the idea of a true fistula.

Upon this idea was built the old pernicious doctrine of free excision, or as free destruction.

Abscesses about the anus present themselves in different forms.

Sometimes the attack is made with symptoms of high inflammation; with pain, fever, rigour, &c. and the fever ends as soon as the abscess is formed.

In this case, a part of the buttock near to the anus is considerably swollen, and has a large circumscribed hardness. In a short time, the middle of this hardness becomes red, and inflamed; and in the centre of it matter is formed.

This (in the language of our ancestors) is called in general a *phlegman*; but when it appears in this particular part, a *phyma*.

The pain is sometimes great, the fever high, the tumour large, and exquisitely tender; but however disagreeable the appearances may have been, or however high the symptoms may have risen, before suppuration, yet, when that end is fairly and fully accomplished, the patient generally becomes easy and cool; and the matter formed under such circumstances, though it may be plentiful, yet is good.

On the other hand, the external parts, after much pain, attended with fever, sickness, &c. are sometimes attacked with considerable inflammation, but without any of that circumscribed hardness, which characterized the preceding tumour; instead of which the inflammation is extended largely, and the skin wears an erysipelatous kind of an appearance. In this, the disease is more superficial; the quantity of matter small; and the cellular membrane sloughy to a considerable extent.

Sometimes, instead of either of the preceding appearances, there is formed in this part, what the French call *une suppuration gangreneuse*; in which the cellular and adipose membrane is affected in the same manner, as it is in the disease called a carbuncle.

In this case, the skin is of a dusky red or purple kind of colour; and although harder than when in a natural state, yet it has, by no means, that degree of tension or resistance, which it has either in the phlegmon, or in the erysipelas.

The patient has generally, at first, a hard, full, jarring pulse, with great thirst, and very fatiguing restlessness. If the progress of the disease be not stopped, or the patient relieved by medicine, the pulse soon changes into an unequal, low, faltering one; and the strength and the spirits sink in such manner, as to imply great and immediately impending mischief. The matter formed under the skin, so altered, is small in quantity, and bad in quality; and the adipose membrane is gangrenous and sloughy throughout the extent of the discoloration. This generally happens to persons, whose habit is either naturally bad, or rendered so by intemperance.

In each of these different affections, the whole malady is often confined to the skin and cellular membrane underneath it; and no other symptoms attend, than the usual general ones, or such as arise from the formation of matter or sloughs in the part immediately affected. But it also often happens, that, added to these effects, the patient is made unhappy by complaints arising from an influence, which such mischief has on parts in the neighbourhood of the disease; such as the urinary bladder, the vagina, the urethra, the hæmorrhoidal vessels, and the rectum; producing retention of urine, strangury, dysury, bearing down, tenesmus, piles, diarrhœa, or obstinate costiveness; which complaints are sometimes so pressing, as to claim all our attention. On the other hand,

large quantities of matter and deep sloughs are sometimes formed, and great devastation committed on the parts about the rectum, with little or no previous pain, tumour, or inflammation.

Sometimes the disease makes its first appearance in an induration of the skin, near to the verge of the anus, but without pain or alteration of colour; which hardness gradually softens and suppurates. The matter, when let out, in this case, is small in quantity, good in quality; and the sore is superficial, clean, and well-conditioned. On the contrary, it now and then happens, that although the pain is but little, and the inflammation apparently slight, yet the matter is large in quantity, bad in quality, extremely offensive, and proceeds from a deep crude hollow, which bears an ill-natured aspect.

The place also where the abscess points, and where the matter, if let alone, would burst its way out, is various and uncertain. Sometimes it is in the buttock, at a distance from the anus; at other times near its verge, or in the perineum, and this discharge is made sometimes from one orifice only, sometimes from several. In some cases, there is not only an opening through the skin, externally, but another through the intestine into its cavity: in others, there is only one orifice, and that either external or internal.

Sometimes the matter is formed at a considerable distance from the rectum, which is not even laid bare by it; at others, it is laid bare also, and not perforated: it is also, sometimes, not only denuded, but pierced; and that in more places than one.

All consideration of preventing suppuration, is generally out of the question: and our business, if called at the beginning, must be to moderate the symptoms; to forward the suppuration; when the matter is formed, to let it out; and to treat the sore in such manner, as shall be most likely to produce a speedy and lasting cure.

When there are no symptoms which require particular attention, and all that we have to do is to assist the maturation of the tumour, a soft poultice is the best application. When the disease is fairly of the phlegmonoid kind, the thinner the skin is suffered to become, before the abscess be opened, the better: as the induration of the parts about will thereby be the more dissolved, and, consequently, there will be the less to do after such opening has been made. This kind of tumour is generally found in people of full, sanguine habits; and who, therefore, if the pain be great, and the fever high, will bear evacuation, both by phlebotomy, and gentle cathartics: which is not often the case of those, who are said to be of bilious constitutions; in whom the inflammation is of a larger extent, and in whom the skin wears the yellowish tint of the erysipelas; persons of such kind of habit, and in such circumstances, being in general seldom capable of bearing large evacuations.

When the inflammation is erysipelatous, the quantity of matter formed is small, compared with the size and extent of the tu-

mour; the disease is rather a sloughy, putrid state of the cellular membrane, than an imposthumation; and therefore, the sooner it is opened, the better: if we wait for the matter to make a point, we shall wait for what will not happen; at least not till after a considerable length of time; during which the disease in the membrane will extend itself, and consequently, the cavity of the sinus, or abscess, be thereby greatly increased.

When, instead of either of the preceding appearances, the skin wears a dusky, purplish-red colour; has a doughy, unresisting kind of feel, and is very little sensible: when these circumstances are joined with an unequal, faltering kind of pulse, irregular shiverings, a great failure of strength and spirits, and inclination to doze, the case is formidable, and the event generally fatal.

The habit, in these circumstances, is always bad; sometimes from nature, but much more frequently from gluttony, and intemperance. What assistance art can lend, must be administered speedily; every minute is of consequence; and if the disease be not stopped, the patient will sink. Here (says Pott) is no need for evacuation of any kind: recourse must be immediately had to medical assistance; the part affected should be frequently fomented with hot spirituous fomentations, a large and deep incision should be made into the diseased parts; and the application made to it should be of the warmest, most antiseptic kind.

This also is a general kind of observation, and equally applicable to the same sort of disease in any part of the body. Our ancestors have thought fit to call it in some a carbuncle, and in others, by other names; but it is (wherever seated) really and truly a gangrene of the cellular and adipose membrane: it always implies great degeneracy of habit, and, most commonly, ends ill.

Strangury, dysury, and even total retention of urine, are no very uncommon attendants upon abscesses forming in the neighbourhood of the rectum and bladder: more especially if the seat of them be near the neck of the latter.

They sometimes continue from the first attack of the inflammation, until the matter is formed, and has made its way outward: and sometimes last a few hours only.

The two former most commonly are easily relieved by the loss of blood, and the use of gum arabic, with nitre, &c. But in the last (the total retention,) they who have not often seen this case, generally have immediate recourse to the catheter; but the practice is essentially wrong.

The neck of the bladder does certainly participate, in some degree, in the said inflammation. But, the principal part of the complaint arises from irritation, and the disease is, strictly speaking, spasmodic. The manner in which an attack of this kind is generally made; the very little distention which the bladder often

suffers ; the small quantity of urine sometimes contained in it, even when the symptoms are most pressing ; and the most certain, as well as safe, method of relieving it ; all tend to strengthen such opinion.

But whether we attribute the evil to inflammation, or to spasmodic irritation, whatever can, in any degree, contribute to the exasperation of either, must be manifestly wrong. The violent passage of the catheter through the neck of the bladder (for violent in such circumstances it must be) can never be right.

If the instrument be successfully introduced, it must either be withdrawn as soon as the bladder is emptied, or it must be left in it : if the former be done, the same cause of retention remaining, the same effect returns ; the same pain and violence must again be submitted to, under (most likely) increased difficulties. On the other hand, if the catheter be left in the bladder, it will often, while its neck is in this state, occasion such disturbance, that the remedy (as it is called) will prove an exasperation of the disease, and add to the evil it is designed to alleviate ; nor is this all ; for the resistance, which the parts, while in this state, make, is sometimes so great, that if any violence be used, the instrument will make for itself a new rout in the neighbouring parts, and lay the foundation of such mischief as frequently baffles all our art.

The true, safe, and rational method of relieving this complaint (says Pott) is by evacuation and anodyne relaxation : this not only procures immediate ease, but does, at the same time, serve another very material purpose ; which is that of maturing the abscess. Loss of blood is necessary ; the quantity to be determined by the strength and state of the patient : the intestines should also be emptied, if there be time for so doing, by a gentle cathartic ; but the most effectual relief will be from the warm bath, or semicupium, the application of bladders with hot water to the pubes and perineum, and, above all other remedies, the injection of clysters, consisting of warm water, oil, and opium. There may have been cases which have resisted and baffled this method of treatment ; but Pott has never met with them.

A painful tenesmus is no uncommon attendant upon an inflammation of the parts about the rectum.

If a dose of rhubarb, joined with a warm anodyne, such as the conf. mithrid. or such like, does not remove it, the injection of thin starch and opium, or tinct. thebaic. is almost infallible.

The bearing down, in females, as it proceeds in this case, from the same kind of cause (viz. irritation) admits of relief from the same means as the tenesmus.

In some habits an obstinate costiveness attends this kind of inflammation, accompanied, not unfrequently, with a painful distention and enlargement of the hæmorrhoidal vessels, both internally and externally. While a quantity of hard feces are detained

within the large intestines, the whole habit must be disordered ; and the symptomatic fever, which necessarily accompanies the formation of matter, must be considerably heightened. And while the vessels surrounding the rectum (which are large and numerous) are distended, all the ills proceeding from pressure, inflammation, and irritation, must be increased. Phlebotomy, laxative clysters, and a low, cool regimen, must be the remedies : while a soft cataplasm applied externally serves to relax and mollify the swollen, indurated piles, at the same time that it hastens the suppuration.

When the abscesses have formed, and are fit to be opened, or when they have already burst, they may be reduced to two general heads, viz.

1. Those, in which the intestine is not at all interested ; and,

2. Those, in which it is either laid bare, or perforated.

In making the opening, the knife or lancet should be passed in deep enough to reach the fluid ; and, when it is in, the incision should be continued upward and downward, in such manner as to divide all the skin covering the matter. By these means, the contents of the abscess will be discharged at once ; future lodgment of matter will be prevented ; convenient room will be made for the application of proper dressings ; and there will be no necessity for making the incision in different directions, or for removing any part of the skin composing the verge of the anus.

Notwithstanding all these collections of matter are generally called *fistulae*, and are all supposed to affect the *intestinum rectum*, yet it is very certain that the seat of the abscess, is sometimes at such distance from the gut, that it is not at all interested by it ; and that none of these cases either are, or can be originally *fistulae*.

In this state of the disease, we have no more necessarily to do with the intestine, than if it was not there ; the case is to be considered merely as an abscess in the cellular membrane.

Suppose a large and convenient opening to have been made by a simple incision ; the contents of the abscess to have been thereby discharged ; and a sore or cavity produced, which is to be filled up.

The term *filling up*, and the former opinion, that the induration of the parts about is a diseased callosity, have been the two principal sources of misconduct in these cases.

The old opinion, with regard to hollow and hardness, was, that the former is caused entirely by loss of substance : and the latter, by diseased alteration in the structure of the parts.

The consequence of which opinion was, that as soon as the matter was discharged, the cavity was filled and distended, in order to procure a gradual regeneration of flesh, and the dressings, with which it was so filled were most commonly of the escharotic

kind, intended for the dissolution of hardness.

The practice is a necessary consequence of the theory. Whoever supposes diseased callosity, and great loss of substance, will necessarily think himself obliged to destroy the former, and to prevent the cavity, formed by the latter, from filling up too hastily. On the other hand, he who regards the cavity of the abscess as being principally the effect of the gradual distraction and separation of its sides, with very little loss of substance, compared with the size of the said cavity; and who looks upon the induration round about, as nothing more than a circumstance which necessarily accompanies every inflammation in membranous parts, more especially in those which tend to suppuration; will, upon the smallest reflection, perceive, that the dressings applied to such cavity ought to be so small in quantity, as to permit nature to bring the sides of the cavity toward each other, and that such small quantity of dressings ought to consist of materials proper only to encourage easy and gradual suppuration.

Suppuration is to be produced and maintained, not by thrusting in such applications, as by their quantity distend, and by their quality irritate and destroy; but by dressing lightly and easily with such as appease, relax, and soften.

If the hollow, immediately it is opened, be filled with dressings (of any kind,) the sides of it will be kept from approaching each other, or may even be farther separated. But if this cavity be not filled, or have little or no dressings of any kind introduced into it, the sides immediately collapse; and, coming nearer and nearer, do, in a very short space of time, convert a large hollow into a small sinus. And this is also constantly the case, when the matter, instead of being let out by an artificial opening, escapes through one made by the bursting of the containing parts.

True, this sinus will not always become perfectly closed; but the aim of nature is not, therefore, the less evident; nor the hint, which art ought to borrow from her, the less palpable.

In this, as in most other cases, where there are large sores, or considerable cavities, a great deal will depend on the patient's habit, and the care that is taken of it: if that be good, or if it be properly corrected, the surgeon will have very little trouble in his choice of dressings; only to take care that they do not offend either in quantity, or quality: but if the habit be bad, or injudiciously treated, he may use the whole farrago of externals, and only waste his own and his patient's time.

By light, easy treatment, large abscesses formed in the neighbourhood of the rectum, will sometimes be cured, without any necessity occurring of meddling with the said gut. But it much more frequently happens, that the intestine, although it may not have been pierced or eroded by the matter, has yet been so stripped or denuded, that no

consolidation of the sinus can be obtained, but by a division; that is, by laying the two cavities, viz. that of the abscess, and that of the intestine, into one.

When the intestine is found to be separated from the surrounding parts by the matter, the operation of dividing it had better (on many accounts) be performed at the time the abscess is first opened, than be deferred to a future one. For, if it be done properly, it will add so little to the pain, which the patient must feel by opening the abscess, that he will seldom be able to distinguish the one from the other, either with regard to time or sensation; whereas, if it be deferred, he must either be in continual expectation of a second cutting, or feel one at a time when he does not expect it.

The intention in this operation is to divide the intestine rectum from the verge of the anus up as high as the top of the hollow in which the matter was formed; thereby to lay the two cavities of the gut and abscess into one; and by means of an open, instead of a hollow or sinuous sore, to obtain a firm and lasting cure.

For this purpose, the curved, probe-pointed knife, with a narrow blade, is the most useful and handy instrument of any. This, introduced into the sinus, while the surgeon's fore-finger is in the intestine, will enable him to divide all that can ever require division; and that with less pain to the patient, with more facility to the operator, as well as with more certainty and expedition than any other instrument whatever. If there be no opening in the intestine, the smallest degree of force will thrust the point of the knife through, and thereby make one: if there be one already, the same point will find and pass through it. In either case, it will be received by the finger in ano; will thereby be prevented from deviating, and being brought out by the same finger, must necessarily divide all that is between the edge of the knife, and the verge of the anus: that is, must by one simple incision (which is made in the smallest space of time imaginable) lay the two cavities of the sinus and of the intestine into one.

Authors make a very formal distinction between those cases in which the intestine is pierced by the matter, and those in which it is not; but although this distinction may be useful when the different states of the disease are to be described, yet in practice, when the operation of dividing the gut becomes necessary, such distinction is of no consequence at all; it makes no alteration in the degree, kind, or quantity, of pain which the patient is to feel; the force required to push the knife through the tender gut is next to none, and when its point is in the cavity, the cases are exactly similar.

Immediately after the operation, a soft dossil of fine lint should be introduced (from the rectum) between the divided lips of the incision; as well to repress any slight hæmorrhage, as to prevent the immediate reunion of the said lips; and the

rest of the sore should be lightly dressed with the same. This first dressing should be permitted to continue, until a beginning supuration renders it loose enough to come away easily; and all the future ones should be as light, soft, and easy as possible; consisting only of such materials as are likely to promote kindly and gradual supuration. The sides of the abscess are large; the incision must necessarily, for a few days, be inflamed; and the discharge will, for some time, be discoloured and gleety: this induration, and this sort of discharge, are often mistaken for signs of diseased callosity, and undiscovered sinuses; upon which presumptions, escharotics are freely applied, and diligent search is made for new hollows; the former of these most commonly increase both the hardness and the gleet; and by the latter new sinuses are sometimes really produced. These occasion a repetition of escharotics, and perhaps, of incisions; by which means, cases which at first, and in their own nature were simple and easy of cure, are rendered complex and tedious.

To quit reasoning, and speak to fact only: In the great number of these cases, which must have been in St. Bartholomew's Hospital, within these ten or twelve years, *I do aver, (says Pott) that I have not met with one, in the circumstances before described, that has not been cured by mere simple division, together with light, easy dressings: and that I have not, in all that time, used for this purpose, a single grain of præcipitate, or of any other escharotic.*

The best and most proper method of dividing the intestine, in the case of a collection of matter formed juxta anum, we have already described.

The intention to be aimed at by incision in the present case, is exactly the same, and ought to be executed in the same manner.

Let us first suppose the matter to be fairly formed; to have made its point, as it is called; and to be fit to be let out.

Where such point is, that is, where the skin is most thin, and the fluctuation most palpable, there the opening most certainly ought to be made, and always with a cutting instrument, not caustic, as was formerly done.

We have supposed the matter of the abscess to have been formed, and collected; but still to have been contained within the cavity, until let out by an incision.

We are now to consider it, as having made its own way out, without the help of art.

This state of the disease is also subject to some variety of appearance; and these different appearances have produced, not only a multiplicity of appellations, but a groundless supposition also, of a variety of essentially different circumstances.

When a discharge of the matter by incision is too long delayed or neglected, it makes its own way out, by bursting the external parts somewhere near to the fundamen-

ment, or by eroding and making a hole through the intestine into its cavity; or sometimes by both. In either case, the discharge is made sometimes by one orifice only, and sometimes by more. Those, in which the matter has made its escape by one or more openings, through the skin only, are called *blind external fistulae*; those, in which the discharge has been made into the cavity of the intestine, without any orifice in the skin, are named *blind internal*; and those, which have an opening both through the skin, and into the gut, are called *complete fistulae*.

Thus, all these cases are deemed fistulous, when hardly any of them ever are so: and none of them necessarily. They are still mere abscesses, which are burst without the help of art; and if taken proper and timely care of, will require no such treatment as a true fistula may possibly stand in need of.

The most frequent of all are what are called the *blind external*; and the *complete*. The method whereby each of these states may be known is, by introducing a probe into the sinus by the orifice in the skin, while the fore-finger is within the rectum: this will give the examiner an opportunity of knowing exactly the true state of the case, with all its circumstances.

Whether the case be, what is called a complete fistula, or not; that is, whether there be an opening in the skin only, or one there, and another in the intestine, the appearance to the eye is much the same. Upon discharge of the matter, the external swelling subsides, and the inflamed colour of the skin disappears, the orifice, which at first was sloughy and foul, after a day or two are past, becomes clean and contracts in size; but the discharge, by fretting the parts about, renders the patient still uneasy.

As this kind of opening seldom proves sufficient for a cure, (though it sometimes does) the induration, in some degree, remains; and if the orifice happens not to be a depending one, some part of the matter lodges, and is discharged by intervals, or may be pressed out by the fingers of an examiner. The disease, in this state, is not very painful; but it is troublesome, nasty, and offensive: the continual discharge of a thin kind of fluid from it, creates heat, and causes excoriation in the parts above; it daubs the linen of the patient; and is, at times, very fetid; the orifice also sometimes contracts so, as not to be sufficient for the discharge; and the lodgment of the matter then occasions fresh disturbance.

The means of cure proposed and practised by our ancestors, were three, viz. caustic, ligature, and incision.

The intention in each of these is the same, viz. to form one cavity of the sinus and intestines by laying the former into the latter. The two first are now completely, and most properly, exploded.

Hitherto we have considered the disease either as an abscess, from which the matter has been let out by an incision, made by a

surge on, or from which the contents have been discharged by one single orifice, formed by the bursting of the skin somewhere about the fundament. Let us now take notice of it, when instead of one such opening, there are several.

This state of the case generally happens when the quantity of matter collected has been large, the inflammation of considerable extent, the adipose membrane very spongy, and the skin worn very thin before it burst.—It is, indeed, a circumstance of no real consequence at all; but from being misunderstood, or not properly attended to, is made one of additional terror to the patient, and additional alarm to the inexperienced practitioner: for it is taught, and frequently believed; that each of these orifices is an outlet from, or leads to a distinct sinus, or hollow: whereas in truth, the case is most commonly quite otherwise; all these openings are only so many distinct burstings of the skin covering the matter; and do all, be they few or many, lead and open immediately into the one single cavity of the abscess: they neither indicate, nor lead to, nor are caused by distinct sinuses; nor would the appearance of twenty of them (if possible) necessarily imply more than one general hollow.

If this account be a true one, it will follow, that the chirurgic treatment of this kind of case ought to be very little, if at all different from that of the preceding; and that all that can be necessary to be done, must be to divide each of these orifices in such manner as to make one cavity of the whole. This the probe-knife will easily and expeditiously do; and when that is done, if the sore, or more properly its edges, should make a very ragged, uneven appearance, the removal of a small portion of such irregular angular parts will answer all the purposes of making room for the application of dressings, and for producing a smooth, even cicatrix after the sore shall be healed.

When a considerable quantity of matter has been recently let out, and the internal parts are not only in a crude, undigested state, but have not yet had time to collapse, and approach each other; the inside of such cavity will appear large; and if a probe be pushed with any degree of force, it will pass in more than one direction into the cellular membrane by the side of the rectum. But let not the inexperienced practitioner be alarmed at this, and immediately fancy, that there are so many distinct sinuses: neither let him, if he be of a more hardy disposition, go to work immediately with his director, knife, or scissors: let him enlarge the external wound by making his incision freely; let him lay all the separate orifices open into that cavity; let him divide the intestine lengthwise by means of his finger in ano; let him dress lightly and easily; let him pay proper attention to the habit of the patient; and wait, and see what a few days, under such conduct, will produce. By this he will frequently find, that

the large cavity of the abscess will become small and clean; that the induration round about will gradually lessen; that the probe will not pass in that manner into the cellular membrane; and consequently, that his fears of a multiplicity of sinuses were groundless. On the contrary, if the sore be crammed or dressed with irritating, or escharotic medicines, all the appearances will be different: the hardness will increase, the lips of the wound will be inverted, the cavity of the sore will remain large, crude, and foul; the discharge will be thin, gleety, and discoloured; the patient will be uneasy and feverish; and, if no new cavities are formed by the irritation of parts, and confinement of matter, yet the original one will have no opportunity of contracting itself; and may very possibly become truly fistulous.

Sometimes the matter of an abscess, formed juxta anum, instead of making its way out through the skin, externally near the verge of the anus, or in the buttock, pierces through the intestine only. This is what is called a *blind internal fistula*.

In this case, after the discharge has been made, the greater part of the tumefaction subsides, and the patient becomes easier. If this does not produce a cure, which sometimes, though very seldom happens, some small degree of induration generally remains in the place where the original tumour was, upon pressure on this hardness, a small discharge of matter is frequently made per anum; and sometimes the expulsion of air from the cavity of the abscess into that of the intestine may very palpably be felt, and clearly heard; the stools particularly, if hard and requiring force to be expelled, are sometimes smeared with matter; and although the patient, by the bursting of the abscess, is relieved from the acute pain which the collection occasioned, yet he is seldom perfectly free from a dull kind of uneasiness, especially if he sits for a considerable length of time in one posture. The real difference between this kind of case, and that in which there is an external opening (with regard to method of cure) is very immaterial; for an external opening must be made, and then all difference ceases. In this, as in the former, no cure can reasonably be expected, until the cavity of the abscess, and that of the rectum, are made one; and the only difference is, that in the one case we have an orifice at, or near the verge of the anus, by which we are immediately enabled to perform that necessary operation; in the other we must make one.

We come now to that state of the disease, which may truly and properly be called *fistulous*. This is generally defined, *sinus angustus, callosus, profundus: acris sanie diffusus*; or, as Dionis translates it, "*Un ulcère profond, & caverneux, dont l'entrée est étroite, & le fond plus large; avec issue d'un pus acre & virulent; et accompagné de callosités.*"

Various causes may produce or concur in producing such a state of the parts concern-

ed as will constitute a fistula, in the proper sense of the word; that is, a deep, hollow sore, or sinus, all parts of which are so hardened, or so diseased, as to be absolutely incapable of being healed, while in that state; and from which a frequent, or daily discharge is made, of thin, discoloured sanies, or fluid.

These are divided into two classes, viz. those which are the effect of neglect, distempered habit, or of bad management, and which may be called, without any great impropriety, local diseases; and those which are the consequence of disorders, whose origin and seat are not in the immediate sinus or fistula, but in parts more or less distant, and which, therefore, are not local complaints.

The natures and characters of these are obviously different by description; but they are still more so in their most frequent event, the former being generally curable by proper treatment; the latter frequently not so by any means whatever.

Under the former are reckoned all such cases as were originally mere collections of matter within the coats of the intestine rectum, or in the cellular membrane surrounding the said gut; but which, by being long neglected, grossly managed, or by happening in habits which were disordered, and for which disorders no proper remedies were administered, suffer such alteration, and get into such state, as to deserve the appellation of *fistulae*.

Under the latter are comprised all those cases, in which the disease has its origin and first state in the higher and more distant parts of the pelvis, about the os sacrum, lower vertebræ of the loins, and parts adjacent thereto; and are either strumous, or the consequence of long and much distempered habits; or the effect of, or combined with, other distempers, local or general; such as a diseased neck of the bladder, or prostate gland, or urethra, &c. &c. &c.

Among the very low people, who are brought into hospitals, we frequently meet with cases of the former kind: cases, which, at first, were mere simple abscesses; but which, from uncleanness, from intemperance, negligence, and distempered constitutions, become such kind of sores, as may be called *fistulous*.

In these the art of surgery is undoubtedly, in some measure, and at some time, necessary; but it very seldom is the first or principal fountain from whence relief is to be sought: the general effects of intemperance, debauchery, and diseases of the habit are first to be corrected and removed, before surgery can with propriety, or with reasonable prospect of advantage, be made use of.

The surgery required in these cases, consists in laying open and dividing the sinus, or sinuses, in such manner that there may be no possible lodgment for matter, and that such cavities may be fairly opened lengthwise into that of the intestine rectum: if the internal parts of these hollows are hard, and do not yield good matter, which is

sometimes the case, more especially where attempts have been made to cure by injecting astrigent liquors, such parts should be lightly scratched or scarified with the point of a knife or lancet, but not dressed with escharotics; and if either from the multiplicity of external orifices, or from the loose, flabby, hardened, or inverted state of the lips and edges of the wound near to the fundament, it seems very improbable that they can be got into such a state as to heal smoothly and evenly, such portion of them should be cut off as may just serve that purpose. The dressings should be soft, easy, and light; and the whole intent of them to produce such suppuration as may soften the parts, and bring them into a state fit for healing.

If a loose, fungous kind of flesh has taken possession of the inside of the sinus, (a thing much talked of, and very seldom met with) a slight touch of the lunar caustic will reduce it sooner, and with better effect on the sore, than any other escharotic whatever.

The method and medicines, by which the habit of the patient was corrected, must be continued (at least in some degree) through the whole cure; and all the excesses and irregularities, which may have contributed to injure it, must be avoided.

By these means, cases which at first have a most disagreeable and formidable aspect, are frequently brought into such state, as to give very little trouble in the healing.

If the bad state of the sore arises merely from its having been crammed, irritated, and eroded; the method of obtaining relief is so obvious, as hardly to need recital.

A patient who has been so treated, has generally some degree of fever; has a pulse which is too hard, and too quick; is thirsty, and does not get his due quantity of natural rest. A sore which has been so dressed, has generally a considerable degree of inflammatory hardness round about; the lips and edges of it are found full, inflated, and sometimes inverted; the whole verge of the anus is swollen; the hæmorrhoidal vessels are loaded; the discharge from the sore is large, thin, and discoloured; and all the lower part of the rectum participates of the inflammatory irritation, producing pain, bearing-down, tenesmus, &c. *Contraria contrariis* is never more true than in this instance: the painful, uneasy state of the sore, and of the rectum, is the great cause of all the mischief, both general and particular; and the first intention must be to alter that state. All escharotics must be thrown out, and disused; and in lieu of them, a soft digestive should be substituted, in such manner as not to cause any distention, or to give any uneasiness from quantity: over which a poultice should be applied: these dressings should be renewed twice a day; and the patient should be enjoined absolute rest. At the same time, attention should be paid to the general disturbance, which the former treatment may

have created. Blood should be drawn off from the sanguine; the feverish heat should be calmed by proper medicines; the languid and low should be assisted with the bark and cordials; and ease in the part must, at all events, be obtained by the injection of anodyne clysters of starch and opium.

If the sinus has not yet been laid open, and the bad state of parts is occasioned by the introduction of tents imbued with escharotics, or by the injection of astringent liquors, (the one for the destruction of callosity, the other for the drying up gleet and humidity) no operation of any kind should be attempted until both the patient and the parts are easy, cool, and quiet: cataplasms, clysters, rest, and proper medicines must procure that: and when that is accomplished, the operation of dividing the sinus, and (if necessary) of removing a small portion of the ragged edges, may be executed, and will, in all probability, be attended with success. On the contrary, if such operation be performed while the parts are in a state of inflammation, the pain will be great, the sore for several days very troublesome, and the cure prolonged or retarded, instead of being expedited.

Abscesses and collections of diseased fluids, are frequently formed about the lumbar vertebræ, under the psoas muscle, and near to the os sacrum; in which cases, the said bones are sometimes carious, or otherwise diseased. These sometimes form sinuses, which run down by the side of the rectum, and burst near to the fundament.

The chirurgic treatment of such sores and sinuses can have no little influence on the remote situation, where the collection of matter is originally formed. (See *Lumbar Abscess*.)

Fistulous sores, sinuses, and indurations about the anus, which are consequences of diseases of the neck of the bladder, and urethra, called fistulæ in perinæo, require separate and particular consideration. (See *Fistula in Perinæo*.)

Pott may be considered as the source and authority of the foregoing remarks.

M. Roux has lately published a sort of critique on the preference, which English surgeons invariably give to Pott's method of operating for the fistula in ano. The chief peculiarity in the French plan, on which he bestows unqualified praise, consists in the use of a kind of director, called a gorget, which is usually made of ebony wood, and intended to be introduced within the rectum with its concavity turned towards the fistula. A steel inflexible director, slightly pointed and without a cul-de-sac, is then passed through the fistula till the point comes into contact with the wooden gorget. A long, narrow, sharp-pointed, straight bistoury is now introduced along the groove of the steel director, till its point meets the groove of the ebony gorget, by cutting upon which all the parts are divided, which lie between the internal opening of the fistula and the anus. It may be objected to this method, that it is not al-

ways easy to make a director pass at once through the fistula into the rectum. This is acknowledged by M. Richerand, who adds, that, in this circumstance, the point of the director may be forced into the rectum, without lessening the chance of the success of the operation. (*Nosogr. Chirurg. T. 3, p. 463, 464. Edit. 4.*) Why then does it matter so much, that the surgeon sometimes pierces the rectum with the point of his curved bistoury? Surely, this is as good an instrument for making the puncture as the pointed director. Besides, it appears to me, that a flexible silver director is more likely to follow the track of the fistula into the rectum, than an unbending iron instrument. I shall say nothing of the awkwardness of using the other wooden director: the finger of the surgeon can always do the office of all such contrivances, with greater safety and convenience. M. Roux also censures us for not *cramming* the wound with charpie; for he is not content with merely introducing into it a dossil of lint. (See *Parallèle de la Chir. Angloise, &c. p. 296. &c.*) His countryman Pouteau, however, knew better long ago: for he has expressed his decided conviction of the utility of cramming the wound with dressings to its very bottom after the third day, when superficial dressings, and the renewal of them as often as cleanliness requires, will be fully sufficient.

For information, relative to former opinions concerning *fistula in ano*, refer to *Celsus*; *Heister's Surgery*; *Le Dran's Operations*; *Sharp's Operations*; *La Faye's Notes on Dionis*; *H. Bass, De Fistula Ani feliciter curanda. in Hallei Disp. Chir. 4, 463*. *J. L. Petit, Traité des Mal. Chir. T. 1 and 2, p. 113. Petit is an advocate for making an early opening, like Pott, and all the best writers on this disease. In Kirkland's Medical Surgery, Vol. 2, may be found an account of the opinions and practice of many former celebrated practitioners. The best modern practical remarks are contained in Pott's Treatise on the Fistula in Ano, in which he has offered also an excellent critique on some opinions of Le Dran, De la Faye, and Cheselden. The reader may also consult with advantage Sabatier's Médecine Opératoire, Tom. 2; B. Bell's Surgery, Vol. 2; Latta's Surgery, Vol. 2; T. Whately, Cases of Polypi, &c. with an appendix, describing an improved instrument for the fistula in ano, 8vo. Lond. 1805. J. T. Oetzmänn, De Fistula Ani, 4to. Jenæ, 1812. Richerand's Nosographie Chirurgicale, T. 3, p. 446, &c. Edit. 4. Roux, Voyage fait à Londres en 1814, ou Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise, p. 396, &c. Paris, 1815. Callisen's Syst. Chirurgie Hodiern. T. 1, p. 470. Schreger, Chirurgische Versuche, B. 2, über die Unterbindung der Mastdarmfisteln, p. 1. 131, 8vo. Nürnberg, 1818. Fr. Reisinger, Darstellung eines neuen Verfahrens die Mastdarmfistel zu unterbinden, &c. 8vo. Augsburg, 1816. Into the consideration of these plans of curing fistula by the introduction of a ligature through them, and tying*

them, I have not judged it advisable to enter, because every method of this kind is most justly exploded from the practice of surgery in this country.

ANUS, PROLAPSUS OF.

Prolapsus ani, technically called also *exania*, or *archoptosis*. In this case, the rectum protrudes in a greater or less degree at the anus, either from mere relaxation of the internal membrane of the bowel, or from a real displacement and inversion of its upper portion, which presents itself as an external tumour. The first form of the disease is that, which is most common. The inner coat of the rectum, being connected to the muscular by a very loose elastic cellular substance, naturally forms several folds, the use of which is to let this bowel dilate sufficiently for the retention of the excrement. The swelling, occasioned by the protrusion of the inner coat of the rectum, or by the actual displacement of a greater part of this bowel, is subject to considerable variety in respect to length and thickness; when small resembling a mere ring; when large and reaching far downwards, having an oblong globular form. The tumour, sometimes, admits of reduction with ease; sometimes it cannot be returned without difficulty. The disease occurs in persons of all ages; but, it is most common in infants and elderly subjects. Such examples as are combined with thickening and relaxation of the inner coat of the rectum, internal hemorrhoids, or other tumours, are sometimes attended with a copious discharge from the anus, and from the prolapsed bowel, of a serous and mucous fluid, mixed with blood. The disease may originate from various causes:

1. From circumstances, which tend to relax and weaken the parts, which retain the rectum, or its inner membrane, in its situation.

2. From various kinds of irritation and pressure on the bowel itself, having the effect of increasing the powers, by which it is liable to be forced outward.

3. From any disease, or irritation in the adjacent parts, and affecting the rectum sympathetically.

Hence, a prolapsus ani may be caused by long habitual crying, and great exertions of the voice; violent coughing; sitting long at stool; hard dry feces, and much straining to void them; obstinate diarrhoea in infants, kept up by dentition; dysentery; chronic tenesmus; various diseases of the rectum itself; the abuse of aloetic medicines and emollient clysters; hemorrhoids; excrescences and thickenings of the inner membrane of the rectum; difficulty of making water; the efforts of parturition; the stone in the bladder; paralysis of the sphincter and levatores ani; and prolapsus vaginae.

Considering the degree of the disease, and the occasional closeness of the stric-

ture, the symptoms are sometimes mild, the rectum generally bearing pressure, exposure to the air, and other kinds of irritation, better than any other bowel. But the urgency and danger of a prolapsus ani are greater when the swelling is large, recent, and conjoined with violent pain, inflammation, and febrile symptoms. When complicated with strangulation, the consequences may be a stoppage of the feces, severe pain, swelling, inflammation, and even gangrené, within the cavity of the abdomen. In short, all the evils may arise which attend strangulated hernia. The prognosis, therefore, varies according to the different degree, species, cause, and complication of the disease. The recent, small, moveable prolapsus ani, the cause of which admits of being at once removed, may be effectually and radically cured. It should always be recollected, however, that when once the rectum has been affected with prolapsus, a tendency to protrusion from any slight occasional cause generally remains. The habitual prolapsus, which has existed for years, and comes on whenever the patient goes to stool, is the case which is most difficult of relief.

The treatment of prolapsus ani embraces three principal indications.

1. The speedy reduction of the prolapsed part.

2. The retention of the reduced bowel.

3. The removal and avoidance of the causes by which the disease is induced.

In general, when the case is recent, and the tumour not of immoderate size, the reduction may be accomplished with tolerable ease, by putting the patient in a suitable posture, with the buttocks raised, and the thorax depressed, and by making gentle and skilful pressure, either with the palm of the hand, or fingers. When difficulty is experienced, the patient, if young or robust, may be bled; and the part be fomented. The large intestines may also be emptied by means of a mild unirritating clyster, and half an ounce of the oleum ricini should be exhibited. In the habitual prolapsus ani the patient himself is generally accustomed to reduce the part, or it goes up of itself when he lies down. When, however, the inflammation and swelling are urgent, the part ought on no account to be irritated with repeated attempts at reduction. The practitioner should rather have recourse to the antiphlogistic plan, especially leeches, fomentations, or cold washes, and the exhibition of the oleum ricini, and when the swelling has been lessened, the reduction may be again attempted. When the reduction is prevented by a spasmodic resistance, the use of an anodyne poultice, or fomentations, a clyster of the same quality, the warm bath, and the internal use of opium, are the best means. Should the complaint not give way to the preceding remedies, and the symptoms become more and more pressing, the particular situation of the stricture should be examined with a probe,

and divided either with a knife and director, or with a concealed bistoury. Some writers speak of the employment of a speculum ani; but on account of the globular form of the disease, it must be difficult of application. Cases are recorded, in which the protruded part, either in the state of gangrene or of chronic hardness, thickening, and elongation, has been removed with a knife, or ligature. (See *Cheselden's Anatomy*, &c. 1741: *Kerstens, Historia Sedis proctidæ, resectione feliciter sanata*, Kilon. 1779; *Whately, in Med. Tracts and Observ.* Vol. 8, No. 16.)

However, I should apprehend, that, in the circumstance of gangrene, the measures best calculated for stopping its course, detaching the sloughs, and keeping up the patient's strength, must always be more prudent, than such an operation.

The reduction having been effected, it is proper to introduce the fore-finger up the rectum, in order to ascertain that no intussusception exists above the anus within the sphincter. The bowel is then to be kept in its place by quietude in the recumbent posture, and, if there be a great tendency to relapse, it will be proper to apply to the fundament a piece of sponge, or compresses, supported with the T bandage. But, if such means should not answer, and an habitual prolapsus ani should recur again and again, which is not unfrequent where the disease has been neglected, or its causes have long remained unremoved, the apparatus described by Mr. Gooch may be tried with more hope of success. (*Chirurgical Works*, Vol. 2, p. 150, Edit. 1792.) Others have used perforated balls of ivory. Callisen found the introduction of a piece of sponge, within the rectum, fastened to a silver probe, give effectual support. In France, instruments, made of elastic gum, have been employed with advantage for supporting the rectum. (*Richerand, Nosogr. Chir.* T. 3, p. 444, Ed. 4.)

On account of the elasticity, and unirritating quality of this substance, I conceive it is better calculated than any other material for the construction of such instruments. It cannot be denied, however, that all foreign bodies in the rectum create serious annoyance. In the female sex, a vaginal pessary, rather prominent behind, usually hinders the recurrence of a prolapsus ani.

The late Mr. Hey has published some highly interesting remarks on the cure of the procidentia ani in adults. In one gentleman, the disease took place whenever he had a stool, and continued for some hours, the gut gradually retiring, and at last disappearing, until he had occasion to go again to the vault. After each stool, he used to place himself in a chair, and obtain a little relief by making pressure on the prolapsed part; and he then was in the habit of going to bed, where the intestine by degrees regained its natural situation. While the bowel was down, there was a copious discharge from it of a thin mucous fluid, blend-

ed with blood. When the part was up, the anus was constantly surrounded by a thin, pendulous flap of integuments, generally hanging down to the extent of three-fourths of an inch. Around the anus, there were also several soft tubercles of a bluish colour, situated at the basis, and at the inner part of the pendulous flap. These were evidently formed by the extremity of the rectum. The patient, previously to the establishment of these habitual attacks of prolapsus ani, had been afflicted for several years with pain after each stool, protuberances at the extremity of the rectum, and discharge of blood and mucus. For these complaints, he applied to Mr. Sharp, who gave him an ointment to be applied after each stool, some soapy pills to be taken, and recommended the use of a clyster a little before the time of going to stool. The latter remedy, however, could not be adopted, and no material benefit was derived from the others. Some years afterwards, when Mr. Hey was consulted, the foregoing symptoms continued, in addition to which there was the grievance of the prolapsus, which came on at every time of going to stool, and lasted for several hours. This judicious surgeon, at first, advised the patient to wash the prolapsed part with a lotion composed of an infusion of oak bark, lime-water, and spirit of wine, and keeping on the tumour compresses, wet with this fluid, and supported by the T bandage. The disease, however, was too obstinate to be cured by this treatment. Nor could Mr. Hey succeed in reducing the bowel, when it came down. "Although (says he) the prolapsed part of the intestine consisted of the whole inferior extremity of the rectum, and was of considerable bulk, yet, the impediment to reduction did not arise from the stricture of the sphincter ani; for, I could introduce my finger with ease during the procidentia; but, it seemed to arise from the relaxed state of the lowest part of the intestine, and of the cellular membrane, which connects it with the surrounding parts. My attempt proved vain, as to its immediate object, yet it suggested an idea which led to a perfect cure of this obstinate disorder. The relaxed state of the part, which came down at every evacuation, and the want of sufficient stricture in the sphincter ani, satisfied me that it was impossible to afford any effectual relief to my patient, unless I could bring about a more firm adhesion to the surrounding cellular membrane, and increase the proper action of the sphincter. Nothing seemed so likely to effect these purposes, as the removal of the pendulous flap, and the other protuberances, which surrounded the anus." This operation was performed on the 13th of November. On the 15th the gut protruded, and did not gradually retire, as it used to do. Mr. Hey attempted to procure ease by means of opiates and fomentations, and avoided immediately trying to reduce the prolapsed part. However, the prolapsus

continued so long, that the appearance of the part began to alter, and, therefore, on the 16th he made an attempt at reduction, and succeeded with great ease. However, as a good deal of pain in the hypogastrium was still complained of, the patient was bled in the evening, and gently purged with the oleum ricini. These means gave relief; but, as some pain in the belly yet continued, an opiate was given. A low diet, linseed tea, lac amygdalæ, &c. were ordered, and a little of the oleum ricini every morning, or every other morning, with an opiate after a stool had been procured. "By proceeding in this manner for some days, regular stools were procured, without any permanent inconvenience. My patient recovered very well, and was freed from this distressing complaint, which had afflicted him so many years." (See *Hey's Pract. Obs.* p. 438, &c. Ed. 2.)

This, and some other cases, which this gentleman has related, convincingly exemplify the necessity of paying attention to the removal of excrescences, hemorrhoids, and other tumours, situated about the lower part of the rectum, in cases of prolapsus ani; for, unless this object be accomplished, the disease may resist every other treatment, and afflict the patient, as long as he lives, in the manner so well described in the above example. An elderly gentleman, whom I know, was troubled for many years with a prolapsus ani, which used to come on several times a week, sometimes at the vault, and sometimes at other periods. Several of the first surgeons were consulted, who failed in affording permanent benefit, because they omitted to extirpate some hemorrhoidal excrescences, situated at the lower part of the rectum; for, when these were afterwards removed, the prolapsus ani entirely disappeared.

The last indication in the treatment is the removal, and avoidance, of all such causes as are known to have a tendency to bring on the complaint. In infants, making them sit on a high close-stool, with their feet hanging freely down, will often prevent a fresh protrusion of the rectum. Every thing, tending to cause either diarrhœa, or costiveness, should be avoided. In the generality of cases, however, there is an inclination to costiveness, which must be obviated by the mildest means. For this purpose Mr. Hey used to prescribe half an ounce of the oleum ricini, which is to be taken every morning, or every other morning, as circumstances may require. The same practitioner sometimes also employed, in addition to this medicine, a clyster composed of a pint of water gruel, and a large spoonful of treacle. The tone of the relaxed intestine is to be restored by the continued use of cold clysters made with the decoction of oak bark, alum, and vinegar. In one obstinate case, under the care of the late Mr. Hey, he recommended the following lotion for washing the part affected, during the state of prolapsus, and he also advised its application to the anus in

the intervals, by means of a thick compress, supported by the T bandage. R. Aquæ calcis simplicis ℥ij Cort. Quercus confus. ℥iv. f. infusum per hebdomadam, et colaturæ adde Sp. Vini rect. ℥iv. ft. lotio. (See *Hey's Pract. Obs.* p. 442, Ed. 2.)

Too much irritability of the rectum may be lessened with opium.

The intussusception of the higher part of the bowel, especially of the colon, or cecum, causing a protrusion at the anus, is always incurable, as it is not in the power of art to rectify the displacement. Some extraordinary cases have proved, however, that large portions of the intestinal canal may, thus inverted, be separated and voided, and the patients recover. (See *Intussusception*.)

According to Mr. Travers, when an artificial anus is complicated with prolapsus, the case very rarely admits of cure. (See *Inquiry into the process of Nature in repairing Injuries of the Intestines*, p. 374.)

Surgical writers have been too much in the habit of confounding together prolapsus ani and intussusception. In the latter disease, they have even fallen into the error of supposing that the whole of the rectum becomes everted, in consequence of the relaxation of the sphincter and levatores ani, and that it then draws after it other portions of the intestinal canal. But, they ought to have been undeceived by the strangulation, which sometimes occurs under such circumstances, and which not only throws a great obstacle in the way of the reduction of the displaced part, but even sometimes brings on mortification. Besides, the connexions of the rectum with the neighbouring parts, by means of the cellular substance, which surrounds it, and the attachment of this intestine to the posterior surface of the urinary bladder, render the above origin of the complaint impossible. Such an explanation could only be admitted with regard to those protrusions of the rectum, which come on in a very slow manner. This account could not afford a satisfactory explanation of certain cases, in which the everted intestine presents itself in the form of an enormous tumour. Fabricius ab Aquapendente mentions his having seen tumours occasioned by a prolapsus of the rectum, which were as long as the fore-arm, and as large as the fist. In the *Mélanges des Curieux de la Nature*, we find an account of a tumour of this sort which was two feet long, and occurred in a woman from parturition. Nor is a more satisfactory reason assigned for these cases, by supposing, that they originate from a relaxation of the villous coat of the rectum, and its separation from the muscular one. We are not authorized to imagine, that such a separation can take place to a considerable extent, nor so suddenly, as to give rise to the phenomena, sometimes remarked in this disease.

Accurate observations long ago removed all doubt upon this subject. In the eleventh volume of the *Mémoires de l'Académie de Chirurgie*, edit. in 12mo. we read an account

of a pretended prolapsus of the rectum, which, after death, was discovered to be an eversion of the cæcum, the greater part of the colon being found at the lower end of this intestine, and most of the rectum at its upper part. This eversion began at the distance of more than eleven inches from the anus, and terminated about five or six from this opening, the tumour, formed by the disease, having been reduced some time before the child's death. It was impossible to draw back the everted part, in consequence of the adhesions, which it had contracted. Another dissection evinced the same fact. A child, having suffered very acute pain in the abdomen, after receiving a blow, had a prolapsus of intestine through the anus, about six or seven inches long. This was taken for a prolapsus of the rectum. After death, the termination of the protruded bowel was found to be the cæcum, which had passed through the colon, and rectum. (See *Intussusception*.)

The reader may consult with advantage : *l'Encyclopédie Méthodique, Partie Chirurgicale, De la chute du fondement, Tom. 1, p. 150. Gooch's Surgical Works, Vol. 2, p. 150. Edit. 1792. Recherches Historiques, sur la Gastrologie, ou l'ouverture du bas ventre, dans le cas du Volvulus, &c. par M. Hevin in Mem. de l'Acad. Royale de Chirurgie, Tom. 11, p. 315. Edit. in 12mo. Richerand's Nosographie Chirurgicale, Tom. 3, p. 444, Edit. 4, &c. Richter's Anfangsg. der Wundarzn. B. 6, p. 403. Edit. 1802. Callisen's Syst. Chirurgiæ Hodiernæ, T. 2, p. 521, Edit. 1800. Hey's Practical Obs. in Surgery, p. 438, &c. Edit. 2. 1810.*

ANUS, ARTIFICIAL.

This signifies an accidental opening in the parietes of the abdomen, to which opening some part of the intestinal canal tends, and through which the feces are, either wholly or in part, discharged.

An artificial anus is always preceded by an injury of the intestinal canal, either a penetrating wound of the abdomen, ulceration of the bowel, and the bursting of an abscess externally ; an operation in which the preternatural opening is purposely made, with the view of saving life in particular cases of imperforate anus ; and accidental wound of the gut in the operation for hernia ; or, lastly, and, most commonly, mortification of the bowel, the effect of the violence and long continuance of the strangulation of the part. All these cases are further divisible into such, as are attended with a destruction of a portion of the intestinal tube, and into those, which are not accompanied with any such loss of substance. Whatever may be the kind of injury, which the bowel has sustained, one thing here invariably happens, viz. the adhesion of the two divided portions of the intestine to the edge of the opening in the parietes of the abdomen. This occurrence, which has the most salutary effect in preventing extravasation of the contents of the bowel in the cavity of

the abdomen, is produced by inflammation, which precedes gangrene, and follows wounds. (See *Œuvres Chir. de Desault, T. 2, p. 352—354.*)

When, in strangulated hernia, the case is not relieved by the usual means ; or when the necessary operation has not been practised in time ; the protruded bowel sloughs ; the adjoining part of it adheres to the neck of the hernial sac ; and the gangrenous mischief spreads from within outwards. If the patient live long enough, and an incision in the tumour be now practised, one or more openings soon form in the integuments, and, through these apertures, the feces are discharged, until the separation of the sloughs gives a freer vent to the excrement. But when an incision is made, the feces are more readily discharged, and, as Mr. Travers has related, this is sometimes the best mode of relief.

"In the ordinary situation of hernia, (as this gentleman has correctly explained,) the portions of intestine, embraced by the stricture, occupy a position nearly parallel. Their contiguous sides mutually adhere ; in the remainder of their circumference, they adhere to the peritoneum, lining, or forming the stricture. The existing adhesion of the contiguous sides, strengthened by the adhesion of the parts in contact, ensures a partial continuity upon the separation of the sphacelated part. The line of separation is the line of stricture. It commences on that side of the gut, which is in direct contact with the stricture. As the separation advances, the opposite adhering sides may perhaps recede somewhat, and a little enlarge the angle of union. But, it is ever afterwards an angle ; and, where the peritoneum is deficient, the canal is simply covered in by granulations from the cellular membrane of the parietes, coalescing with those of the external, or cellular surface of the peritoneum." (*On the process of Nature in repairing Injuries of the Intestines, p. 360.*) It must be confessed, that few surgeons have entertained sufficiently accurate ideas of the changes, which happen around the wounded, or mortified portion of intestine, when an artificial anus is produced ; and though Desault's account was excellent, as far as it went, it was not until the year 1809, when Scarpa published his valuable work on Hernia, that the whole process of nature on such occasions was completely elucidated. The hernial sac, (says he) does not always partake of gangrene with the viscera contained in a hernia, and even when it does slough, since the separation of the dead parts happens on the outside of the abdominal ring, there almost always remains in this situation a portion of the neck of the hernial sac perfectly sound. It may be said therefore, that, in all cases, immediately after the detachment of the mortified intestine, whether it happen within, or on the outside of the ring, the two orifices of the gut are enveloped in the neck of the hernial sac, which, soon becoming adherent to them by the effect of in-

inflammation, serves for a certain time to direct the feces towards the external wound, and to prevent their effusion in the abdomen. In proportion as the outer wound diminishes, the external portion of the neck of the hernial sac also contracts; but, *that part, which embraces the orifices of the intestine, gradually becomes larger, and at length forms a kind of membranous funnel-shaped, intermediate cavity, which makes the communication between the two parts of the bowel.* However, according to Scarpa's investigation, this adhesion of the neck of the hernial sac, round the two orifices of the gut, does not hinder the latter from gradually quitting the ring, and becoming more and more deeply placed in the cavity of the abdomen. The base of the above described funnel-shaped membranous cavity corresponds to the bowel, and its apex tends towards the wound, or fistula.

But, in relation to this part of the subject, there are some other circumstances which every surgeon should well understand, and his ignorance of them would not be excusable, on the ground of their not having been, like the funnel-shaped membranous cavity, forming the communication between the two orifices of the bowel, only a discovery of recent date; for, they were fully explained many years ago. I here allude to the exact position of the two portions of the bowel, with respect to each other, the direction of their orifices, the angle, or ridge between them, and the difference in their diameters. The first of these circumstances, viz. the position of the two parts of the bowel, as we have seen, is pointed out by Mr. Travers, who represents them as occupying a position nearly parallel, and cites an interesting observation recorded by Pipelet. The patient was a woman, 56 years old; the loop of spoiled gut was from five to six inches long; the contents of the bowel were discharged through the wound for a considerable time, and an artificial anus was established. Some accidental obstruction occurred; a purgative was given, which operated in the natural way, and, in fifteen days, the wound was healed. She lived in perfect health to the age of 82, when she died of a disease not connected with this malady. Pipelet examined the body, and has given a figure representing the union. The line of the intestine formed an acute angle, where it adhered to the peritoneum, opposite to the crural arch. The cylinder is evidently much contracted. Pipelet particularly dwells upon the angular position and constriction of the tube at the point of union. The lower continuation of the intestinal tube was also remarked to be more contracted than the upper portion, a circumstance correctly referred by Mr. Travers, to the undilated state of the bowels, situated between the artificial and the natural anus. (See *Mém. de l'Acad. de Chir.* T. 4, p. 164, and *Travers on Injuries of the Intestines*, p. 364.) The two ends of the bowel, as Scarpa has observed, are always found lying in a more or less paral-

lel manner by the side of each other; the upper, with its orifice open, and directed towards the external wound by the feces, which issue from it, while the lower, which gives passage to nothing, becomes less capacious, and is retracted further into the abdomen. Hence, the breach in the intestinal canal is never repaired by the orifices of the upper and lower portions of the bowels reuniting, coalescing, and running, as it were, into each other. Indeed, they meet at a very acute angle; the axis of one does not correspond to that of the other; and their orifices never lie exactly opposite each other. It is in short by means of the funnel-shaped cavity, formed by the remains of the hernial sac, that the two parts of the bowel communicate, and the feces, in order to get from the upper into the lower continuation of the intestine, must first pass in a semicircular track through that funnel-shaped cavity, there being between the orifices of the bowel, directly opposite to the communication between the cavity of the intestine and that of the funnel-shaped membrane, *a considerable projection, or jutting angle, forming a material additional obstacle to the direct passage of the feces from the upper into the lower portion of the intestinal tube.* (Scarpa sull' *Ernie Memorie*, Anat. Chirurgiche, Milano, 1809.)

Desault, after noticing the efficiency of the adhesions between the injured part of the bowel and the edge of the opening in the parietes of the abdomen, in preventing extravasation, remarks, that, if such adhesions were entire, the abdominal parietes would form a substitute for the portion of the canal, which has been destroyed, and the contents of the bowel would continue to pass, as usual, towards the anus, if the portions of the intestine separated and adherent to the neighbouring parts, did not form such an acute angle as obstructs the passage of the intestinal matter. The more acute this angle is, the greater is the obstruction; when the two parts of the bowel lie nearly parallel, the entrance into the lower portion of the canal is completely prevented; but, if they meet at a right angle, then more or less of the contents of the upper portion may be transmitted into the lower. The first disposition chiefly happens when a considerable part of the intestinal canal has been destroyed, or when the tube has been completely divided; while the second posture is principally remarked in all cases where the injury has been less extensive. And it is plain, that the possibility of a cure depends materially on the kind of angle, at which the two portions of bowel meet, and that the projection of the internal frænum, or jutting membranous ridge between the two orifices, is always a greater or lesser obstacle to the cure.

With respect to the diminution, which occurs in the diameter of the part of the intestinal canal, between the artificial opening and the natural anus, Desault admits the correctness of the observation, but entirely dissents from such authors as have

spoken of the change, as sometimes proceeding so far, that an obliteration of that portion of the intestinal tube is the consequence. The mucus secreted within it suffices for preventing this obliteration; a secretion which, in these cases, is copious, and is partly voided from the rectum, in the form of white flakes. And, if any further proof were needed, that the bowels between the artificial and natural ani remain pervious, it is furnished by the fact, that, in cases of artificial anus, the lower continuation of the tube frequently becomes inverted, and protrudes. On the other hand, the kind of obliteration, above spoken of, has never been demonstrated by dissection: it was not observed by Lecat, in the examination of the body of a person who died twelve years after the entire cessation of the passage of feces *per anum*; nor was it found to exist by Desault, when he opened a patient who died of marasmus in the Hotel-Dieu, in consequence of an artificial anus, which communicated with the ileum, and had lasted two years. (*Œuvr. de Desault, T. 2, p. 354-56.*)

However proper the formation of an artificial anus may be, in many cases, in which the patient's life depends upon the event, it must be confessed, that the consequence is a most afflicting and disgusting infirmity. This truth cannot be denied, though the feces which are discharged, from not having been so long retained in the bowels, may not be so fetid as those which are evacuated in the ordinary way. As the opening, which gives vent to the excrement, is not endued with the same organization as the lower end of the rectum, and as, in particular, it is not furnished with any sphincter capable of contracting and relaxing itself, as occasion requires, the feces are continually escaping without any knowledge of the circumstance on the part of the patient. Hence the uncleanly state of the parts around the external opening; and their frequently excoriated fungous state. Some persons in this state, among the number of those whose histories are on record, have made use of a metal box, in which their excrement has been received. Schenckius relates the case of an officer who was wounded in the belly, and who allowed his feces to escape into a vessel made for the purpose. Dionis makes mention of a similar case. What occurred to an invalid soldier, says this eminent writer, is too singular to serve as an example in practice, since nature alone preserved him, by making the wound of the abdomen serve as an opening for the discharge of his feces. The intestine has become adherent to it, and he daily evacuates his excrement through this opening. The matter coming away involuntarily, necessitates him to have a tin box for its reception.

Moscatti also communicated to the Academy of Surgery, the history of a wounded man, in whom an artificial anus took place, in consequence of a wound in the abdomen

below the right hypochondrium. His excrement used to be received in a tin box, fastened to him by a belt. The above surgeon very properly remarks, as rather a singular circumstance in this wound, that it admitted of a leaden cannula being introduced, to which cannula the tin box was accommodated.

Uncleanliness is not the only inconvenience of an artificial anus. Persons have been known to be quite debilitated by the affliction, and even ultimately to die in consequence of it. This is liable to happen, whenever the intestinal canal is opened very high up, so that the aliment escapes before chylicification is completed, and the nutritious part of the food has been taken up by the lacteals. In this circumstance, the patient becomes emaciated, and sometimes perishes, as Desault had an opportunity of observing, and examples of which are also recorded by Hoin and Le Blanc. In cases of this description, the matter voided has little fetor, and is frequently sourish. In all instances, the matter is evacuated involuntarily, because there is nothing like a sphincter. But, when the opening only interests the lower convolutions of the ileum, or, what is more frequent, when it has occurred in the large intestines, the danger is less serious, and patients, in this state, are often noticed performing all their functions very well, and, with the exception of colic, to which they are subject, enjoying as good health as they did previously to their having the present disease. In such examples, the matter voided is more fetid, its discharge does not follow so quickly its introduction into the stomach, and it is retained for a longer time.

Many patients, afflicted with an artificial anus, void no feces at all from the rectum; but they occasionally go to the vault, for the purpose of voiding a thick whitish substance, which is the mucous secretion of the portion of the large intestines nearest to the anus. Under certain circumstances, the quantity of this mucus discharged is more copious. (*Desault, l'ol. cit. p. 359.*)

The most grievous occurrence, to which persons with an artificial anus are exposed, is a prolapsus of the bowel, similar to what sometimes happens through the anus, with respect to the rectum. The descent of the bowel is sometimes simple, only affecting a portion of the intestinal canal just above or below the opening. On other occasions, the complaint is double, the bowel both above and below the opening being prolapsed. This descent of the intestine forms a tumour, the dimensions of which vary considerably in the different subjects in whom it is observed. When the protrusion is caused by the upper part of the intestinal canal, the feces are voided at the extremity of the tumour, and, when the swelling consists of the lower portion of the bowel, the excrement is evacuated at the base of the prolapsed part. By observing this evacuation, when the tumour is double,

it is easy to know to which end of the intestinal canal each protruded portion belongs. This consequence of an artificial anus is very serious, because it greatly increases the inconvenience which the patient suffers. Sometimes, the tumour is exquisitely sensible; and, occasionally, when the eversion of the intestine is considerable, a strangulation is produced, which puts the patient's life in danger.

I apprehend no well-informed surgeon of the present day can doubt, that formerly the frequency of artificial ani after hernia, was seriously increased by the absurd measures sometimes adopted for the express purpose of preventing them; and, as Mr. Travers has rightly observed, the cases reported by the old surgeons, if they prove any thing, prove this: "that the canal has been very generally restored, when the artificial anus was reckoned upon as inevitable, and that where an officious solicitude had been at work to prevent it, showing itself in an active interference with the arrangements of nature, the case has terminated in artificial anus; so that the event, either way, has been a matter of surprise to the surgeon. The fear of doing too little, or too much, applies only to the pernicious customs of dilating the stricture, displacing, amputating, and sewing the intestine; the general adoption of which practice fully accounts to my mind for the number of artificial ani, which are the sequelæ of hernia." (*Op. cit. p. 367.*)

The treatment of an artificial anus, is either palliative, or radical. The first consists in obviating the habitual uncleanness, produced by the involuntary discharge of the intestinal matter, and in relieving such bad symptoms, as may arise from the disorder.

The first indication is fulfilled by the employment of silver, or tin machines, which are either kept applied to the external opening by means of a spring, or form receptacles placed more or less off the artificial anus, from which the intestinal matter is transmitted through a tube, kept constantly in the opening. In general, says Desault, as elastic gum is supple, light, and capable of taking any shape, it is the best material for the construction of such instruments, which, however, rarely answer their purpose completely, and always give the patient a great deal of trouble.

As for the second indication, Richter, with the view of hindering the too quick escape of the intestinal matter, and the death of the patient from this cause, proposed covering the opening for a certain time with a piece of sponge, supported by an elastic bandage, or truss. But Loeffler found this method objectionable, as it was apt to bring on colic, constipation, and inflammation, and excoriation of the skin.

When the outer opening is disposed to contract too much, and inconveniences arise from this change, Sabatier is an advocate for preventing such closure by means of a tent, or skein of silk, introduced into

the aperture, and changed very often for the sake of cleanliness; while others prefer a ring of ivory for the purpose. But the irritation produced by the matter imbibed by this sort of tent, and in particular the liability of the bowel to protrude, and be strangulated in the opening of the ivory ring, are found strong objections to these practices; and, according to Desault, the sponge, employed by Richter, also occasions a great deal of excoriation by the irritation of the fluid which is lodged in it.

For the purposes of hindering a protrusion of the gut, of keeping the opening sufficiently pervious, of relieving any uneasiness and tenesmus, of hindering the intestinal matter from escaping in the intervals of dressing, and confining it long enough for the adequate nourishment of the patient, Desault preferred a linen tent, or stopper, covered by a pad of charpie, compresses, and a tight bandage. At first, says he, the patient feels some uneasiness from this plan, and slight colics may be the consequence of it; but, by degrees, the parts become habituated to their new state, and every thing goes on well. With respect to the employment of tents and plugs, with the views above indicated, I am disposed to think the practice can rarely be advisable, and that any necessity for it may be obviated by attention to diet, and the occasional exhibition of laxative medicines and clysters, as will be hereafter noticed. When the gut protrudes, its reduction is to be effected in the same way, as a common prolapsus ani; but considerable difficulty will occur when the protruded part is inflamed, thickened, and of considerable size. Surgeons, indeed, have usually regarded the reduction as being impracticable in these circumstances; but, according to Desault, this is not the case, as compression with a bandage, kept up for some days, will succeed. Care must be taken, however, to leave a sufficient opening for the passage of the feces. Whatever may be the size of the protrusion, Desault argues, that it should be the invariable rule of the surgeon to endeavour to return the part by the means here suggested. (*See Œuvres Chir. de Desault, T. 2, p. 361, &c.*)

The radical cure is what is next to be considered. The business of the surgeon is to prevent, if possible, the formation of an artificial anus; but, when the event has occurred, and, particularly, when the whole, or the greater part, of the stools is discharged in this way, no attempt must be made to stop up the opening, without a great deal of consideration; for, any effort of this kind, made under circumstances which do not justify it, may be the means of exposing the patient's life to the most alarming danger. Sometimes, indeed, without any interference of the surgeon, the outward opening contracts, and, the issue of the intestinal matter being obstructed, pain and tenesmus are excited; and the same consequences may be produced by any swelling and enlargement of the

projecting ridge, situated between the two portions of the bowel. In two cases, Puy found this swelling take place in such a degree, that the patients fell victims to the complete stoppage of the intestinal contents. The symptoms which arise, are then similar to those which happen in strangulated hernia. Hoin, Le Blanc, and Sabatier, also cite instances, in which the patients lost their lives by gangrene being brought on by this species of strangulation. (*Desault, Vol. cit. p. 360.*)

There is a period (says Mr. Travers,) at which the function of the lower portion of the canal, with a little assistance, may be restored. The natural order of events, connected with this recovery, has been mistaken and inverted. Practitioners have closed the wound, instead of conducting the matter by purgatives and clysters into the large intestines. Now, the wound will never fail to heal, when the matter recovers its accustomed route; but, this condition cannot be reversed. The restoration is safest, when most gradual; when there is evidence of an existing sympathy between the repair of structure, and the return of function. According to the same gentleman, there is reason to believe, that the well-timed exhibition of a single purgative might often prove effectual. "If the food is rapid, and little changed, in its passage, it should be pultaceous and nutritive, and given in moderate quantity at short intervals; while injections of the same kind should be administered at least twice in twenty-four hours, and retained as long as possible." He states, that, by such means, patients may be nourished for many weeks. If the discharge is sparing, and does not readily escape, he recommends an occasional purgative in less than ordinary quantity. He disapproves of other medicines, especially stimulants, and all such food as is difficult of digestion, giving a general preference to animal food in a gelatinous form. He bestows just praise on strict attention to cleanliness, and in opposition to Desault and Sabatier, condemns the employment of tents and sponges. (*Op. cit. p. 371, 373.*)

Numerous cases on record furnish abundance of proof, that the feces, after being voided for several months from the wound, produced by the operation for hernia, frequently resume their natural course. Facts of this kind, which in general may be said to be common where the intestine is without loss of substance, are not very rare even where more or less of the bowel has been destroyed by gangrene; and many illustrations of this remark may be found in the writings of Petit, Pott, Le Dran, &c. The greater number of these instances of success, as already stated, were the result of the most simple, unofficious treatment, or rather of the undisturbed, and very little assisted, efforts of nature.

In the radical cure of an artificial anus, the following are the general indications laid down by Desault: 1. To reduce the

gut when it protrudes, and is everted. 2. To prevent the issue of the feces from the wound, so that they may be obliged to pass on towards the rectum, at the same time that the healing of the external opening is to be promoted. 3. To obviate any internal impediments to the passage of the matter into the lower part of the intestinal canal.

How the first of these objects is to be accomplished in the case of greatest difficulty, that is, when the parietes of the bowel are thickened, has been already explained. Experience proves, says Desault, that the second indication cannot be fulfilled by means of sutures. The best thing for this purpose he represents to be the linen stopper, above spoken of as a means for preventing the protrusion of the bowel. Here it answers the double object of hindering such a protrusion, and filling up the fistulous opening, so as to make the contents of the bowel tend towards the anus. Desault argues, that the surgeon need not be apprehensive of the tent doing harm by keeping the wound from healing. The first aim, he says, should be to determine the feces to take their natural route; and when this has been done by closing the external opening, the tent may be removed, and this opening will spontaneously close.

However, when the internal impediment is too great, it must be overcome, ere such treatment can be successful. According to Desault, the most frequent impediment, here alluded to, is the angle formed by the two portions of the intestine, and it must be enlarged, and rendered less acute, in order that the feces may continue their route. This desirable change he recommends to be effected by introducing long dossils of charpie into the two ends of the bowel, and gradually altering their direction so as to bring it into one same straight line. When the dilatation is sufficient, and the inner angle, or ridge, is effaced, the long dossils need not be continued. The linen tent, with the precaution of not introducing it too deeply, lest it obstruct the course of the feces itself, will then suffice. When this plan is skilfully managed, Desault says, there will be a great chance of its succeeding, and its beneficial effect will be denoted by a rumbling in the bowels, and frequently by slight colics. At first, wind is discharged from the rectum, and, soon afterwards, the feces begin to come away. On the contrary, if they should not pass with facility, the colic should become violent, and an accumulation happen in the upper portion of the intestinal canal, the tent must be withdrawn, and the other cause of obstruction be considered, and, if possible, removed. (*Vol. cit. p. 365, &c.*)

In the preceding columns, I have given a full explanation of the impediment, made to the passage of the feces into the lower orifice of the intestinal canal, by the projecting septum, or ridge between the two parts of the bowel, and the matter having to traverse the funnel-shaped membranous

cavity in quite a semicircular track. A representation of this septum may be seen in Scarpa's work. Tab. 9, Fig. 1. and also in the sixth plate of Mr. Travers's Inquiry. In one example, in which this septum was plainly visible in the wound, Dupuytren passed into the orifice of the upper part of the bowel a curved needle, and, passing it through the projecting septum, brought it out again through the orifice of the lower portion of the gut. Thus, he included a considerable part of the septum in a ligature, which was daily made thicker, with a view of first exciting inflammation in the two layers of this septum, and thus ensuring their adhesion together, and his next plan consisted in making a division through the part embraced by the ligature, whereby, the passage of the feces into the lower portion of the bowel was made quite free. But, as the section, made by the ligature, was too superficial, Dupuytren completed the division of the septum with a knife; but peritonitis and the death of the patient ensued. In another case, this eminent surgeon tried to render the layers of the septum adherent by compressing them between the blades of a pair of forceps of particular construction, and afterwards he effected the division of the part by augmenting the compression, by means of a screw, traversing the handles of the instrument. In a case which followed the operation for the bubonocoele, attended with mortification of the bowel, Dupuytren began with dilating the outer opening with a bistoury, and, after ascertaining the position of the septum between the two orifices of the bowel, he introduced one of the blades of the forceps into each portion of the gut, and closed the instrument with the screw. The part of the instrument, situated externally to the ridge, or septum, he covered with charpie and a compress. The constriction was soon followed by colic pains, and tendency to vomit, which symptoms, however, were quickly removed by fomenting the belly. They recurred, however, the instrument became loose, and some discharge ensued. On examination, the septum was found to be partially divided. After the breadth of the instrument had been lessened, it was applied again; but when the screw was turned, the patient began to suffer such violent pain over the whole of the abdomen, that it was necessary to diminish the pressure; and, as the instrument was afterwards separated from the parts in a fit of vomiting, it was withdrawn. A trial was now made to determine, the feces towards the rectum by pressure on the external opening; but the plan could not be endured, and the hinderance to the egress of the intestinal matter was so oppressive, that it was discontinued. As the forceps used on the foregoing occasion, did not take sufficient hold of the septum, nor divide it properly, the instrument was somewhat altered. Dr. Reisinger has published three cases, in which it was successfully employed by Dupuytren. In the first of these examples when the instrument had

been applied, it embraced the septum so well, that it could not be displaced from it. The colic attacks, vomiting, thirst, furred tongue, and loss of appetite, which ensued, soon gave way after the belly had been fomented; the constriction was then increased, and found to produce less and less indisposition. On the 29th, very little of the feces came out of the artificial anus, and, after a short time five natural evacuations took place. The blades of the instrument were now completely closed, and, on taking it out, a slough of membrane was found between the blades; a proof, that the septum was destroyed. On the 30th, the patient's health was undisturbed. Clysters was now administered, with the view of promoting evacuations in the natural manner; and, the next day, the patient had a proper motion, without any assistance, and a very small quantity of the feces passed out of the fistulous opening. This aperture was now merely covered with charpie; but, as some high granulations were rising, the powder of colophonium was sprinkled upon them, and compresses and a bandage were applied. The use of clysters was also daily continued, though the patient voided his feces in the natural way. On discontinuing the external pressure, the quantity of discharge from the fistulous opening increased; and, therefore, on the 1st of October, the compresses were again applied, and kept on the part with a spring truss. The treatment ended in a perfect cure.

In another case, Dupuytren enlarged the lower angle of the outer opening with a bistoury, and, after feeling with his finger, that both orifices of the bowel were close to that opening, he applied the forceps. In the evening, the constriction was increased, which was followed by severe colic pains over the whole abdomen. They subsided, however, the following day. From the outer opening, a great deal of slimy excrement was discharged. The constriction was not augmented. On the 5th day, the patient was attacked in the night, with pain and vomiting. The following night was also very restless. Though the belly was not tense, it could not bear to be touched. On the 11th and 12th days, the patient was nearly free from pain; and, by means of clysters, two natural motions were procured; and, on the 13th, as the patient was easy, Dupuytren began to make pressure on the fistulous opening. On the 26th, the edges of the aperture were touched with lunar caustic; and, on the 28th, a compress, supported by a spring truss, was applied. The patient was kept constantly in the horizontal posture; the feces began to be voided the natural way regularly, and the opening contracted in the most favourable manner.

I think the generality of surgeons will agree with Dr. Reisinger, that the foregoing treatment cannot be indiscriminately adopted, in all descriptions of patients, without danger. It should never be tried too soon after the formation of an artificial anus; but time should be allowed for the irritability

and sensibility of the gut, and especially of the septum, to be lessened by the effect of the air and the pressure of the feces. Nor should the trial ever be made ere it has been fully ascertained, that nature cannot herself bring about the cure. Many other interesting observations on this new proposal may be perused in Dr. Reisinger's tract, the title of which is given in the list of works at the end of the present article. In order not to incur the risk of extravasation of the feces in the abdomen, the constriction of the septum should never be increased with imprudent haste, before the adhesive inflammation has had time to be produced between the layers, of which that part is composed.

I shall conclude with the relation of an interesting case of artificial anus, complicated with prolapsus, as recorded by my friend Mr. Lawrence.

"If the complaint (a mortified hernia) terminates in the formation of an artificial anus, we must endeavour to alleviate those distressing inconveniences, which arise from the involuntary discharge of wind and feces through the new opening, by supplying the patient with an apparatus, in which these may be received as they pass off. An instrument of this kind, the construction of which appears very perfect, is described by Richter (*Anfangsgr. der Wundarzn.* vol. 5.) from the *Traité des Bandages* of Juville. The patient will be best enabled to adapt any contrivance of this sort to the particular circumstances of his own case. It has been found, in some instances, that a common elastic truss, with a compress of lint under the pad, has been more serviceable than any complicated instrument. (*Parisian Journal*, vol. 1. p. 193.) in preventing the continual flow of feculent matter from the artificial opening." (*Treatise on Hernia*, p. 206.)

"I know," says Mr. Lawrence, "a patient with an artificial anus, in whom the gut often protrudes to the length of eight or ten inches, at the same time bleeding from its surface. This is attended with pain, and compels him to lie down; in which position the intestine recedes. The patient has now discharged all his feces at the groin for fifteen years; and has enjoyed tolerable health and strength during that time. His evacuations are generally fluid; but sometimes of the natural consistence. Whenever he retains his urine, after feeling an inclination to void it, a quantity of clear, inoffensive mucus, like the white of an egg, amounting to about four ounces, is expelled from the anus; and this may occur two or three times in the day." (P. 208.)

When the protruded intestine is strangulated, an operation may become necessary for the removal of the stricture. (*Schmucker, Vermischte Chirurgische Schriften*, t. 2.) Two cases which terminated fatally from this cause, are mentioned by Sabatier, in a memoir in the 5 tom. de l'Acad. de Chir. Mr. Lawrence also refers to Le Blanc Précis d'Opérations de Chir. tom. 2. p. 445. We should always endeavour to prevent such protrusions, when a disposition to their for-

mation seems to exist by the use of a steel truss, which should, indeed, be worn by the patient, independently of this circumstance. If the tumour has become irreducible by the hand, an attempt may be made to replace it by keeping up a constant pressure on the part, the patient being at the same time confined to bed. By these means, as we have already noticed, Desault, (*Parisian Journal*, vol. 1. p. 178.) returned a very large prolapsus, and, by pressure on the opening, the feces were made to pass entirely by the anus, although, for four years, they had been voided only through the wound. (*Lawrence*, p. 209, 210.)

In cases of mortified hernia, the wound sometimes closes, except a small fistulous opening, which discharges a thin fluid, and cannot be healed. Mr. Lawrence has related, in his excellent treatise on hernia, a case, in which the feces came from the wound some time after an operation, although the bowel did not appear gangrenous when this proceeding was adopted. (P. 211.)

In the appendix to this work, the author adds some further account of the case of artificial anus, which he has related. (P. 208.) The man is sixty years of age, and appears to be healthy, active, and even younger than he really is. He had had a scrotal hernia, which ended in mortification, and involved the testicle of the same side, and a large portion of the integuments, in the destruction. It is now nearly seventeen years since this event, and the feces have, during all this time, been discharged from the groin. He has never made use of a truss, nor taken any step, except that of always keeping a quantity of tow in his breeches.

The prolapsed portion of intestine varies in length and size at different times. It was four inches long when Mr. Lawrence saw it, and the basis, which is the largest part, measured nearly six inches in circumference. The prolapsus never recedes entirely, and it has occasionally protruded to the length of eight or ten inches, being as large as the forearm, and emitting blood. This occurrence is painful, and only comes on when the bowels are out of order. Warm fomentations, and a recumbent position, afford relief, and accomplish a reduction of the bowel.

The projecting part is of an uniform red colour, similar to that of florid and healthy granulations. The surface, although wrinkled and irregular, is smooth and lubricated by a mucous secretion. It feels firm and fleshy, and can be squeezed and handled without exciting pain. The man has not the least power of retaining his stools. When these are fluid, they come away repeatedly in the course of the day, and with considerable force. When of a firmer consistence, there is only one stool every one or two days, and the evacuation requires much straining. Such feces are not broader than the little finger. When the patient is purged, the food is often voided very little

changed. This is particularly the case with cucumber. In this state, he is always very weak. Ale is sometimes discharged five minutes after taken, being scarcely at all altered. The bowels are strongly affected by slight doses of purgatives.

Consult Sabatier, in *Mém. de l'Acad. de Chirurgie*, t. 5. 4to. and in *Médecine Opératoire*, t. 2. *L'Encyclopédie Méthodique, Partie Chirurg.* Richter's *Anfangsgr. der Wundarzn.* Band. 5. J. R. Tieffenbach, *Vulnerrum in intestinis lethalis occasione casus rarissimi, quo colon vulneratum, inversum per 14 annos ex abdomine propendens exhibetur*; Haller's *Disp. Chir.* 5. 61. *Parisian Chirurg. Journal*, v. 1. *Œuvres Chirurg. de Desault* par Bichat, t. 2. p. 352, &c. *Schmucker's Chirurgische Schriften*, vol. 2. Lawrence's *Treatise on Hernia*. Callisen's *Systema Chirurgie Hodiernæ*, t. 2. p. 710, &c. Travers, *Inquiry into the Process of Nature in repairing Injuries of the Intestines*, chap. 8. 8vo. Lond. 1812. Scarpa sull' *Ernie Memorie Anatomico-Chirurgiche*, fol. Milano, 1800. *Anzeige einer von dem H. Professor Dupuytren erfundenen, und mit dem glücklichsten Erfolge ausgeführten Operationssweise zur Heilung des Anus Artificialis, nebst Bemerkungen von Franz Reisinger*; Augsburg, 1817. Hennen's *Military Surgery*, p. 407, &c. ed. 2. 8vo. Edinb. 1820. Three cases from gunshot wounds; the cure effected by aiding nature with the exhibition of occasional laxatives and clysters. All irritating plans were avoided. Scarpa represents the artificial ani, which follow wounds, as far more difficult of cure, than those, which are the consequence of hernia, with mortification; yet I have known many of the first description of cases cured.

*AORTA. Aneurisms of this vessel have already been treated of; but there are a few other particulars, relating to this important artery, which seem to merit notice in a dictionary of surgery.

WOUND OF THE AORTA NOT ALWAYS FOLLOWED BY INSTANTANEOUS DEATH.

A case exemplifying this fact, was some time ago recorded by M. Pelletan. In the month of May, 1802, a young military man, of middling strength, applied at the Hotel-Dieu. In a duel, he had been run through with a foil, which penetrated above the right nipple, and came out at the left loin. The most alarming symptoms were apprehended; but several days elapsed without any serious complaints taking place. The patient was bled twice, and kept on a very low regimen. Every thing went on quietly for a fortnight. He now complained of severe pains in his loins, and he was relieved by the warm bath. He seemed to be recovering, got up, and went to walk in the garden allotted for the sick; but the pain in his loins quickly returned, attended with difficulty of breathing, constipation, and wakefulness. He now became very impatient, and out of temper with the surgeons for not relieving him.

On the 15th of July, two months after the accident, a deformity of the spine was remarked, about the eighth dorsal vertebra. The patient grew rapidly worse, and died in the utmost agony, saying that he felt suffocated, and tearing of the shirt, that his chest might be free from the pressure of all kinds of clothing.

On the body being opened, the right side of the chest was found full of blood, coagulated in various degrees, and an opening, the diameter of which was equal to that of a writing pen, was detected in the aorta above the crura of the diaphragm. All the adjacent cellular substance was injected with blood, and three of the dorsal vertebrae were found carious. No mark of injury was perceptible in any of the thoracic or abdominal viscera. (See *Pelletan's Clinique Chirurgicale*, t. 1. p. 92—94.)

THICKENING AND CONSTRICTION OF THE AORTA.

Meckel met with two cases, in which the aorta was thickened and considerably constricted, just below its arch; yet, in both subjects, there was every reason to believe, that the abdominal viscera and lower extremities had been duly supplied with blood.

This fluid, which could only pass from the heart with great difficulty, and in small quantities, had, by regurgitating, lacerated the semilunar valves. (*Mém. de l'Acad. Royal de Berlin*, 1756. Obs. 17 and 18.) A similar example is recorded by Stoerk. (*Ann. Med.* 11. p. 171.) An instance, in which a stricture was met with in the aorta, opposite to the termination of the canalis arteriosus, is described by Mr. A. Cooper. The little finger could hardly pass through the constriction, which impeded the course of the blood through the heart and lungs, and was attended with a considerable dilatation of the right ventricle. (*Surgical Essays*, vol. 1. p. 103, 8vo. Lond. 1818.)

OBLITERATION OF THE CAVITY OF THE AORTA.

It is observed by Professor Scarpa, that the whole body may be regarded as an anastomosis of vessels, a vascular circle, and he contends, that this remark is so true, that even an obliteration of the aorta itself, immediately below its arch, may take place, without the general circulation of the blood in the body being stopped. Such a disease of the aorta was seen by Paris in the body of a woman. While she lived, the blood, which was expelled from the heart, was transmitted into the trunk of the aorta, below the constriction, and it got there by passing through the subclavian, axillary, and cervical arteries, into the mammary, intercostal, diaphragmatic, and epigastric arteries. From these latter arteries, the blood passed into the vessels of the thoracic and abdominal viscera, and those of the lower extremities. (See *Desault's Journal*, t. 2.)

107. *Brasdor, in Recueil Périodique de la Soc. de Med. 1. 3. No. 18.)*

Dr. Graham, of Glasgow, published another example, in which the aorta was completely obstructed, just below the canalis arteriosus. The particulars are detailed in the *Med. Chir. Trans. vol. 5. p. 287.*

Dr. Goodison, of Wicklow, in examining the dead body of a woman, in the Hospice de la Pitié at Paris, and endeavouring to trace the origin of the inferior mesenteric artery, discovered a hard tumour, placed upon the aorta, and accompanied with an obliteration of that vessel from the origin of the inferior mesenteric artery downwards the remainder of its length; the left iliac being also rendered impervious down to its bifurcation, and the right for more than one half of its length. The corpora sesamoidea of the semilunar valves of the aorta were considerably enlarged, and the mitral and tricuspid valves presented the appearances termed by Corvisart "vegetations." The arch of the aorta was greatly enlarged, and internally was studded with patches of bone. The vessels given off from the trunk, and especially the lumbar arteries, were all noticed to be considerably increased in size. At the obliterated part of the abdominal aorta, there was a firm bony sheath, covering the vessel for about two inches, and filled with a hard fleshy substance, which extended further upwards, and was firmly adherent to the coat of the artery. It was the inner coat itself which was ossified. For a particular account of the vessels, which were chiefly enlarged for the purpose of continuing the circulation, I must refer to Dr. Goodison's description. The general appearance of the body was not unhealthy; and the lower extremities, which were not emaciated, must have been well supplied with blood. The history of the case could not be traced. Mr. Crampton having carefully compared Dr. Goodison's narrative with the preparation taken from this subject, refers the obliteration of the aorta to the effects of the process, by which an aneurism had been spontaneously cured; in which particular, this case is quite different from those reported by M. Paris, and Dr. Graham. (See *Dublin Hospital Reports, vol. 2. p. 293, &c. 8vo. 1818.*)

The next case which I shall notice, is one of the most memorable in the annals of surgery, since it was nothing less than an operation, in which a ligature was applied to the aorta of a living subject, under circumstances which, as far as my judgment extends, warranted even this desperate attempt to preserve life. Mr. A. Cooper had often placed ligatures round the aorta in dogs, and found that the blood was readily carried by the anastomoses to their posterior extremities. (See *Med. Chir. Trans. vol. 2. p. 158.*) A porter, aged thirty-eight, was admitted into Guy's Hospital, April 9, 1817, for an aneurism in the left groin, situated partly above, and partly below, Poupart's ligament. The swelling was considerably diffused, and pressure upon it gave a great deal of pain.

On the third day from his entrance into the hospital, the tumour increased to double its former size, and the pulsation became less distinct. The blood could be felt in a fluid state within the sac, which was so large that no operation was practicable, without opening the peritoneum. Mr. A. Cooper therefore waited, in order to let the man have the chance of a spontaneous cure. Notwithstanding the practice of venesection and compression, the swelling continued to increase, and, on the 20th of June, a bleeding took place from a point of the tumour, where a slough had formed. The bleeding recurred from time to time, and on the 25th he was so much exhausted by loss of blood that his feces passed involuntarily, and his immediate death was only prevented by pressure on the opening. At nine o'clock in the evening, this experienced surgeon made a small incision into the sac above Poupart's ligament, and introducing his finger, tried if it were practicable to pass a ligature round the external iliac artery, within the cavity; but the thing was found impossible, as, instead of the vessel, "only a chaos of broken coagula" could be perceived. At the moment of withdrawing the finger, two students compressed the aorta against the spine, and the incision was then closed with a dossil of lint; Mr. A. Cooper now determined to apply a ligature to the aorta itself. "I made (says he) an incision three inches long, into the linea alba, giving it a slight curve, to avoid the umbilicus. One inch and a half was above, and the remainder below, the navel," the cut being inclined towards the left side. "Having divided the linea alba, I made a small aperture into the peritoneum, and introduced my finger into the abdomen; and then, with a probe-pointed bistoury, enlarged the opening into the peritoneum to nearly the same extent as that of the external wound. Neither the omentum nor the intestines protruded; and, during the progress of the operation, only one small convolution projected beyond the wound." With his finger nail he scratched through the peritoneum, on the left side of the aorta, and then gently moving his finger from side to side, he gradually passed it between the aorta and spine, and again penetrated the peritoneum on the right side of the aorta. A blunt aneurismal-needle, armed with a single ligature, was next conveyed under that vessel, and tied, with the precaution of excluding the intestines from the noose. The wound was then closed, by means of the quilled suture and adhesive plaster. During the operation, the feces were discharged involuntarily, and the pulse both immediately, and for an hour after the operation, was 144. An opiate was given, and the involuntary passage of feces soon ceased. The sensibility of the right leg was very imperfect. In the night, the patient complained of heat in the abdomen; but he felt no pain upon pressure; and the lower extremities, which had been cold a little while after the operation, were regaining their heat, but

their sensibility was very indistinct. At six o'clock the following morning, the sensibility of the limbs was still imperfect; but at eight o'clock the right one was warmer than the left, and its sensibility returning. At noon, the temperature of the right limb was ninety-four; that of the left, or aneurismal one, eighty-seven and a half. At three o'clock, an enema was ordered. The heat of the right leg was now ninety-six; that of the left, or diseased limb, eighty-seven and a half. It is unnecessary, here, to detail all the various circumstances which preceded the patient's death. Vomiting, pain in the abdomen and loins, involuntary discharge of urine and feces; a weak pulse, cold sweats, &c. were some of the most remarkable symptoms. At eight o'clock on the second morning after the operation, the aneurismal limb appeared livid and cold, more particularly round the aneurism; but the right leg was warm; and between one and two o'clock, the same day, the patient died. On opening the abdomen, there was not the least appearance of peritoneal inflammation, except at the edges of the wound; and the omentum and intestines were of their natural colour. The ligature, which included no portion of intestine or omentum, was placed round the aorta, about three quarters of an inch above its bifurcation. When the vessel was opened, a clot, of more than an inch in extent, filled it above the ligature; and below the bifurcation, another clot, an inch in extent, occupied the right iliac artery, while the left contained a third, which extended as far as the aneurism. The neck of the thigh-bone was also found broken within the capsular ligament, and not united; an accidental complication. As there were no appearances of inflammation of the viscera, Mr. A. Cooper refers the cause of the man's death to the want of circulation in the aneurismal limb, which never recovered its natural heat, nor any degree of sensibility, though the right leg was not prevented from doing so; hence, says this experienced surgeon, "in an aneurism similarly situated, the ligature must be applied before the swelling has acquired any very considerable magnitude." (*Surgical Essays*, vol. 1. p. 114, &c.)

Indeed, the most important conclusions from this case are—First, that, where no other impediments exist, the circulation will continue in the lower extremities, though the abdominal aorta be tied, or suddenly obstructed. Secondly, that suffering aneurismal swellings to become very large, before the operation is done, exposes the patient to considerable disadvantage, on account of the pressure of the disease upon the surrounding anastomoses, whereby the continuance of the circulation is rendered less certain than it would be, were the operation done at an earlier period.

RUPTURE OF THE AORTA WITHIN THE PERICARDIUM.

The surgical writings of Scarpa, in rela-

tion to the formation of aneurisms, have now gained extensive celebrity in the world. It is well known, that this author maintains the doctrine, that, in all aneurisms, the internal and muscular coats of the artery are ruptured, and that the aneurismal sac is not formed of these tunics, but of the dilated cellular sheath, which surrounds the vessel. When a large aneurism bursts, there is always a double rupture; one of the artery; another of the aneurismal sac. The last is that, which is the immediate cause of the patient's destruction, by altering the *circumscribed* state of the aneurism into the *diffused*.

There are some exceptions, however, to the foregoing statement, and Scarpa has not failed to point them out. When the internal and muscular coats of the aorta are ruptured in a situation, where the outside of the vessel is only covered by a thin, tense, closely adherent membrane, such membrane may be ruptured at the same time with the proper coats of the artery, and sudden death be occasioned by the effusion of blood in the cavity of the thorax. These events are liable to happen, whenever the proper coats of the aorta are ruptured, within the pericardium, where the vessel is only covered by a thin layer reflected from this membranous bag. Walter has recorded one example of this kind, and Morgagni several others. A similar case is related by Scarpa. (See *Haller Disput. Chir. Tom. 6. Acta Medic. Berlin. Vol. 8, p. 86. Morgagni de Sed. et Causis Morb. Epist. 26, art. 7. 17. 21. Epist. 27, Art. 28. Scarpa on Aneurism, trans. by Wishart, p. 81. Also Hodgson on the Diseases of Arteries and Veins.*)

STEATOMATOUS TUMOURS OF THE AORTA.

Two steatomatous tumours were noticed by Stenzel in the body of a male subject. They were situated in the substance of the membranes of the aorta, immediately below its arch. Notwithstanding these swellings rendered the vessel almost impervious, the man had the appearance of strength, and of having been well nourished. *Hæc corpora fere cor magnitudine æquabant ut omnem propemodum exeunti e sinistri cordis thalamo sanguini spatium præcluderent. De Steatomatibus in principio arteriæ aortæ, &c. Wittemb. 1723.*

This is another striking fact, illustrating the great power of the inosculation to carry on the circulation.

APHÆRESIS. (from ἀφαιρέω, to remove.) This term was formerly used in the schools of surgery, to signify that part of the art, which consists in taking off any diseased, or preternatural portion of the body.

APONEUROSIS. The expression νεύρον was applied by Hippocrates and other ancient writers to tendons and ligaments as well as nerves, all which parts seemed to resemble each other in having a white fibrous texture.

Matter often collects under aponeuroses in different situations of the body, parti-

cularly under the tendinous expansion, which cover the muscles of the thigh, the leg, and the fore-arm. Abscesses are also sometimes met with under the temporal, the palmar, and the plantar fasciæ; in the tendinous thecæ, which include the flexor tendons of the fingers; and, occasionally, also, in the aponeurotic sheath, in which the rectus abdominis muscle is situated.

One particular effect of an aponeurosis, or any kind of tendinous expansion, lying between a collection of matter and the skin, is materially to retard the progress of the pus towards the surface of the body. Hence if the case be allowed to take its own course, the quantity of matter increases, the pus spreads extensively under the aponeurosis in every possible direction, separates the muscles from such fascia, and the muscles from each other, and the abscess does not burst till a vast deal of mischief has been produced, together with more or less sloughing of the fascia, tendons, &c. These circumstances cannot happen, without a considerable degree of constitutional disturbance, and a permanent loss of the use of certain muscles. Even when a spontaneous opening is formed, and some of the matter escapes, it is often only a very imperfect discharge; for, the aperture generally occurs, not in a depending situation, nor over the main collection of pus, but, at a part, where the aponeurosis is most thin, and consequently, where the matter had the least resistance to overcome in getting to the surface of the body.

In all such cases, the chief indication is to make an early and a depending opening with a lancet, so as to prevent the extension of the abscess, and to let the matter escape as fast as it is formed. If a spontaneous opening should have occurred in an unfavourable place, a new aperture must be made in a proper situation; or if the former should be sufficiently depending, and near the principal accumulation of matter, but too small, it must be rendered larger with a curved bistoury and a director. Whenever any black dead pieces of fascia, or tendons, present themselves at the opening, they must be taken hold of with a pair of forceps, and extracted.

APOSTEME, or APOSTUME. An abscess.

APPARATUS. This implies the preparation, and arrangement of every thing necessary in the performance of an operation, or in the application of dressings. The apparatus varies according to circumstances. Instruments, machines, bandages, tapes, compresses, pledgets, dossils of lint, sponges, basins of water, towels, &c. &c. are parts of the apparatus, as well as any medicinal substances used.

It is a rule in surgery to have the apparatus ready before an operation is begun. All preparations of this kind should be made, if possible, out of the patient's room and presence, as they might agitate and render him timid.

We have been lately censured by a French

surgeon, for our too common neglect of what has been here recommended. "In France (observes M. Roux) we are careful not to let a patient, who is to undergo a serious operation, see any of the requisite preparations for it. We hasten as much as possible the immediate preparatory measures, in order not to prolong unnecessarily the restlessness and moral agitation, which the expectation of an operation, and sometimes of the slightest one, always produces. These precautions are neglected by the English surgeons, at least, by most of those whom I saw operate. They even neglect them in private practice, where, more commonly than in hospitals, we have to deal with pusillanimous individuals, who are easily alarmed, and whose extreme susceptibility it is of importance to spare. It was in the very room, where the patient lay, of course under his eyes, that the table, and all the necessary instruments for lithotomy, were arranged, at an operation, which I saw done in London, during my stay in that capital, by a gentleman at the head of his profession." (See *Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise*, p. 105.)

M. Roux, in his visit to London, had also too good reason to complain of the slovenly objectionable practice of leaving the application of the tourniquet, and the dressing of the wound after a surgical operation, to mere novices and students. I entirely coincide with him, that, in respect to the dressings in particular, a surgeon is bound to extend his attention and solicitude a little beyond the moment, when the operation terminates.

APPARATUS MINOR; APPARATUS MAJOR; APPARATUS ALTUS. Three ways of cutting for the stone. (See *Lithotomy*.)

AQUA PICIS LIQUIDÆ. *Dubl.* Take of tar two pints; water a gallon. Mix them with a wooden rod for a quarter of an hour, and after the tar has subsided, let the liquor be strained, and kept in well-corked bottles. This lotion is often used in cases of porrigo. Ulcers on the legs, are sometimes extensively surrounded with a scorbutic redness, and pimples. In such instances, the aqua picis, used as an application round the limb, over the dressings, is of great service. (See *Liquor*.)

ARGENTII NITRAS. (*Nitrate of silver, lunar caustic.*) Is the best of the mildest caustics. Its utility for stimulating indolent ulcers, and keeping granulations from rising too high, is well known to every surgeon.

Mr. Hunter sanctions the use of the argentum nitratum, on the first appearance of a chancre, before absorption can be supposed to have taken place. He directs the caustic to be scraped to a point, like a blacklead pencil; so that, when it is applied, every part of the surface of the chancre may be touched with it; and he advises the repetition of this process, till the last slough, which is thrown off, leaves the sore florid and healthy.

This treatment when the sore is very small, may sometimes be advisable, as a means of lessening the chance of the constitution being infected by absorption. In general, surgeons combine with the plan the moderate use of mercury.

The important use of the *argentum nitratum*, in the cure of numerous diseases, we shall have occasion to remark in various places of this work; particularly when we come to the article *Cornea, ulcers of; Iris, prolapsus of; Ulcers; Urethra, strictures of, &c.*

The *argentum nitratum* is often used in the form of a solution, in the proportion of a dram of the caustic to an ounce of distilled water. In general this application ought to be at first more or less diluted with distilled water. Cancerous ulcers; and sores about the nose and neighbouring parts of the face, being examples of *lupus, or noli me tangere*, are often considerably benefited by the *argentum nitratum*, both in the solid and fluid state. The solution agrees also very well with certain sores, which occur round the roots of the nails of the fingers and toes. The lotion is sometimes applied with a camel-hair pencil; but in general, by dipping little soft bits of lint in the fluid, laying them on the part, and covering them with a pledget.

ARNICA. *Leopardsbane.* Amaurosis is the principal surgical case, in which this medicine is now ever employed. Its repute in the cure of that disease also chiefly prevails abroad; for, I believe, in this country, surgeons have no confidence in it, as a remedy for amaurotic disorders.

ARSENIC is the chief ingredient in a secret remedy, which has long possessed very great celebrity in Ireland for the cure of cancer, and is now well known among surgeons, by the name of Plunket's caustic. This application consists of the *ranunculus acris*, the greater crow-foot, the *flammula vulgaris*, and the lesser crow-foot, in the proportion of an ounce of each, bruised and mixed with a drachm of the white oxide of arsenic, and five scruples of sulphur. The whole is to be beaten into a paste, formed into balls, and dried in the sun. When required for use, these balls are beaten up with yolk of egg, and spread upon a piece of pig's bladder. The use of the *ranunculus* is to destroy the cuticle, upon which the arsenic would have no effect; for it is to be observed, that Plunket's caustic was employed for the dispersion of tumours, as well as for the relief of ulcerated cancers. The application is to remain on the part twenty-four hours, at the end of which time, the slough is to be dressed with any simple unirritating ointment. When arsenic was first recommended as an application for cancers, it used generally to be blended with opium. When Plunket's caustic is employed, so as to form an eschar over a scirrhus tumour, I conjecture, that if it ever do good, it is not by any specific effect of this arsenical application, but simply as a slough, or issue, formed near the disease in any other manner. It is

highly probable, also, that the swellings, which have been thus dispersed, have never been complicated with the structure characteristic of true scirrhi. With respect to cancerous ulcers, Plunket's caustic sometimes evidently produces a degree of amendment, which, however, rarely lasts for any considerable time; but, there are many inveterate ulcerations, and anomalous sores, which derive permanent benefit from the application, and are even completely cured by it. Some examples of *lupus*, ulcerations about the roots of the nails, and reputed carcinomatous sores of the lips, are of this description.

At Paris, an arsenical paste is often used by Dubois, and other surgeons of that capital, for cancerous sores of the penis, and other malignant ulcers. It is composed of 70 parts of cinnabar, 22 of sanguis draconis, and 8 of the white oxide of arsenic, formed into paste with saliva at the time when it is to be employed. "The pain and inflammation that succeed the use of it (says Mr. Cross,) cannot be equalled by the severest operation with the knife." (*Sketches of the Medical Schools of Paris, p. 45, 8vo. 1815.*) Even death may be occasioned by the absorption of the poison, as appears from the two annexed facts, the first of which is recorded by M. Roux, in his *Medecine Operatoire*. "The day after the paste was applied, the patient complained of colic and severe vomiting, and in two days perished in convulsions, *et les plus vives angoisses*. The body went quickly into putrefaction. The internal coat of the stomach and a great part of the intestinal canal, were inflamed, and marked here and there with dark spots. Just before I visited Paris, (adds Mr. Cross,) I dissected in London a woman, who died under similar circumstances, and where the same morbid appearances were presented, &c." (*Op. cit.*)

Mr. Justamond's applications to cancer, originally suggested by a receipt, said to be preserved in the Earl of Arundel's family, were somewhat varied. They were generally combinations of arsenic and sulphur. The above receipt directs an ounce of yellow arsenic, with half that quantity of armenian bole, and sometimes as much red precipitate. Mr. Justamond also employed a sulphuret of arsenic, and a combination of this sulphuret with crude antimony. The arsenical preparation, selected for use, was scraped, and laid on the middle of the sore, the edges of which were moistened with a combination of the muriate of iron and muriate of ammonia. In some instances, we learn, that the effects of the treatment were the correction of the fetid smell, melioration of the appearance of the sore, and separation of the cancerous part.

In the *Pharmacopœia Chirurgica*, Mr. Justamond's arsenical caustic is directed to be made in the following manner. *R. Antimonii pulverizati ʒj. Arsenici pulverizati ʒij.* These are to be melted together in a crucible. The application may be reduced to any degree of mildness by blending with

this pulverized caustic a quantity of opium in the form of powder, which was also supposed to act specifically in diminishing pain.

The powder of white oxide of arsenic, unmixed with other substances, has sometimes been sprinkled upon cancerous and other inveterate ulcers; but, the practice is now abandoned by every judicious surgeon, on account of the violent pain resulting from it, and the not unfrequent fatal consequences of its absorption. Could I suppose a man, so rash and ignorant as to revive this murderous practice, yet existed in the profession, I should feel disposed to lengthen these remarks: but I am persuaded, that, in this country, at least, more judgment and knowledge every where prevail. The white oxide of arsenic, however, may be applied with more prudence in other forms; either in one of those already specified; or, as a lotion composed of eight grains of the oxide, and the same quantity of subcarbonate of potash, dissolved in four ounces of distilled water: or, as an ointment formed by rubbing together one drachm of the oxide, and twelve drachms of spermaceti ointment. (See *A. T. Thomson's Dispensatory*, p. 51.)

Febure's celebrated remedy consisted of ten grains of the white oxide of arsenic, dissolved in a pint of distilled water, to which were then added an ounce of the extractum conii, three ounces of the liquor plumbi subacetatis, and a drachm of laudanum. With this fluid, the cancer was washed every morning. M. Febure likewise gave arsenic internally; and his prescription was two grains of the white oxide, a pint of distilled water, syrup of chichory q. s. and half an ounce of rhubarb. Of this mixture, a table spoonful was given every night and morning, with half a drachm of the syrup of poppies. Each dose contained about one-twelfth of a grain of arsenic; but, in proportion as the patient was able to bear an increased quantity, the dose was gradually augmented to six table spoonfuls of the solution.

The arseniate, or rather superarseniate, of potash, is an excellent preparation for internal exhibition. The Dublin Pharmacopœia directs it to be made as follows: take of white oxide of arsenic, nitrate of potassa, each an ounce. Reduce them separately to powder; then, having mixed them, put them into a glass retort, and place it in a sand-bath, exposed to a gradually raised heat, until the bottom of the retort becomes obscurely red. The vapours, arising from the retort, should be transmitted through distilled water, by means of a proper apparatus, in order that the nitrous acid, extricated by the heat, may be disengaged. Dissolve the residue in four pounds of boiling distilled water, and after due evaporation, set it apart, in order that crystals may form. This preparation has long been known under the name of Macquer's arsenical neutral salt. It may be given in the following way: *R. Potassæ Superarseniat. gr. ij. Aq. Menthæ Sativæ Spirit. ℥iv. Vinosi tenuioris ℥j. M. et cola.*

Dosis drachmæ duæ ter quotidie.

The kali arsenicatum, or, as it ought to be called, the superarseniate of potash, may also be given in the form of the pills, made up with crumb of bread, each of which may contain from one-sixteenth to one-eighth of a grain of the arsenical salt.

The following is Dr. Fowler's method of preparing arsenic for internal use: take of the white oxide of arsenic, and pure subcarbonate of potash, each sixty-four grains. Boil them gently in a Florentine flask, or other glass vessel, with half a pound of distilled water, until the arsenic is dissolved. To this solution, when cold, add half an ounce of the compound spirit of lavender, and as much water as will make the whole equal to a pint, or fifteen ounces and a half in weight. The dose of this solution, of which the liquor arsenicalis L. P. is a near imitation, is as follows: from two years old to four M. ij. or iij to v; from five to seven M. v. to viij; from eight to twelve M. viij to x; from thirteen to eighteen M. x to xii; from eighteen upwards M. xii. These doses may be repeated every eight, or twelve hours, the medicine being diluted with thick gruel, or barley water. As the preparation is decomposed by the infusion and decoction of cinchona, it should never be ordered with either of these medicines.

The white oxide of arsenic may be given in the form of pills, made by mixing one grain of it with ten of sugar, and then beating up the mixture with a sufficient quantity of the crumb of bread to form ten pills, one of which is a dose. It will only be in my power to specify here a few of the numerous surgical cases, in which the internal employment of arsenic has been proposed. The following are particularly worthy of attention; tetanic affections; cancer; lupus; elephantiasis; inert cases of lepra; (See *Baileman's Pract. Synopsis of Cutaneous Diseases*, p. 33, Ed. 3.) various unnamed malignant ulcers; certain forms, or sequelæ of the venereal disease, or other unintelligible diseases, which cannot be subdued by mercury; different cutaneous affections, &c. A longer list of diseases, for which a trial of arsenic is suggested, may be seen in some papers published by Mr. Hill. (*Edinb. Med. and Surg. Journ. Vol. 5, 6.*)

Arsenic has also been recommended by Dr. J. Hunter, for the prevention of hydrophobia. (See *Trans. of a Society for the Improvement of Med. and Chir. Knowledge, Vol. 1.*) Later trials of the medicine, however, in this particular case, do not appear to entitle it to any confidence. Dr. Marcet found it quite unavailing, though not less than three drops of Fowler's solution were taken every other hour, in two drachms of peppermint, or sweetened water. (See *Med. Chir. Trans. Vol. 1, p. 141, 156.*) After the symptoms of hydrophobia have once begun, arsenic is decidedly useless.

But, although it fails in hydrophobia, some facts published by Mr. Ireland, surgeon to the 60th regiment, make it appear a truly valuable and efficacious remedy for

counteracting the poison of serpents. (See *Med. Chir. Trans. Vol. 2. p. 393.*)

ARTERIOTOMY. (from *arteria*, an artery, and *temno*, to cut.) The operation of opening an artery, for the purpose of taking away blood for the relief of diseases. (See *Bleeding.*)

ARTERIES. The process, by which a divided, or punctured artery is healed, is particularly considered under the word *Hemorrhage*; while the general principles, which ought to be observed in the application of the means for the stoppage of bleeding, may be collected partly from the remarks, contained in that part of the work, and partly from what is stated in the articles, *Amputation, Aneurism, and Ligature.* As the condition of a bleeding patient admits of no delay, and the preservation of his life entirely depends upon proper measures being immediately taken, no man ought to be suffered to profess surgery, who is not competent to the treatment of wounded arteries, whether injured by accident, or in a surgical operation. As Langenbeck observes, an ignorant practitioner, when called to a case of serious hemorrhage, is thrown into such consternation, as actually deprives him of the power of rendering prompt assistance. Pale as a corpse, and trembling, he beholds the jet of blood; and for the sake of appearing to do something, perhaps, he applies spirit of wine, or a very tight bandage, and cries out for further aid; while simple pressure with the thumb upon a certain point in the vicinity of the injury, would prevent all this confusion, and a dangerous loss of blood. No part of surgery, in fact, is of higher importance, than the treatment of wounded arteries, and it deserves, therefore, to be earnestly studied by every practitioner, whether he move in the higher, or the lower sphere of the profession. And, as a proof of the necessity of country surgeons making themselves acquainted with the subject, he recites the case of a turf-cutter, who let the instrument with which he worked fall against the lower part of his leg, whereby the posterior tibial artery was wounded. The blood gushed out profusely, and the surgeon who was sent for, applied a tourniquet to the popliteal artery, and thus stopped the bleeding for a time; but, unfortunately, the tourniquet was kept so long on the limb, that the foot mortified, and sloughed away. (*Bibl. für die Chir. B. 1. p. 231, 232. Gott. 1806.*) From the explanations, delivered in the article *Hemorrhage*, it will be seen, that, in all bleedings from considerable arteries, nothing is equal to the ligature, as a means for preventing the further loss of blood; and it may be laid down as a standing rule, that each extremity of the wounded vessel should be tied as near as possible to the wound in its coats. As Mr. Hodgson has remarked, "the necessity of tying both ends of a wounded artery is evident from the fact, that the anastomoses in all parts of the body, are so extensive, as to furnish a supply of blood, which may pass through

the lower extremity of the wounded vessel in a sufficient stream to produce an alarming, and, in some instances, a fatal hemorrhage" (*On Diseases of Arteries, &c. p. 469.*) This correct observation is followed by a case, in which the bleeding from the lower end of a divided brachial artery caused the patient's death. Of course, the inference is, that both extremities of the vessel ought to have been tied directly after the receipt of the wound. With regard to tying the trunk of an artery in a part of the limb, where it can be exposed with facility, when it is difficult to secure its bleeding extremities, as Mr. Hodgson remarks, the practice "was falsely deduced from a knowledge of the fact, that the ligature of an artery at a distance from the disease will effect the cure of an aneurism." But, a more intimate acquaintance with the condition of a limb after such an operation, and the processes, by which the cure of an aneurism is effected after the modern operation, afford a complete illustration of the inefficacy and danger of this mode of treating a wounded artery; for it is now fully proved, that, when an artery is tied, a stream of blood continues to pass through it below the ligature. (*p. 471.*) This well-informed surgeon is aware, however, that instances do occur, in which only the upper end of a wounded artery is tied, and yet the patient recovers without hemorrhage from the lower orifice, which is closed by the natural processes.

In the year 1814, in Holland, I took up the femoral artery, in the middle of the thigh, in a case, in which the popliteal artery had given way, ten days after the passage of a musket-ball through the ham. I employed only one smallish ligature, which was applied with the precaution of not detaching the artery from its natural connexions. The hemorrhage was effectually stopped, and the wound healed in the most favourable manner. Here, no doubt, the inflammation in the ham had obliterated the portion of the artery immediately below the point at which it had sloughed, or ulcerated, and there might even have been from the same cause some deposition of lymph within the upper portion of the popliteal artery, contributing to the success of the operation. But, no doubt, it was the diminution of the impulse of the circulation by the ligature of the femoral artery, which enabled nature to complete the obliteration of the wounded part of the vessel. Sometimes, says Mr. Hodgson, when hemorrhage takes place, a few days after the bleeding from a wounded artery has been stopped by compression, one extremity of the vessel will be pervious, whilst the other will have closed by the natural processes. Cases have even occurred, in which the upper end of the artery has been closed by the natural processes, whilst those processes failed in effecting the obliteration of the lower extremity of the vessel, from which a serious hemorrhage took place. (*Hodgson, Op. cit. 475, and Guthrie in New Med.*)

and *Phys. Journ.* Vol. 4, p. 177.) Indeed, in the example in which I took up the femoral artery myself, it was impossible to say positively, whether the blood came from the part of the popliteal artery above, or below the slough in it, as no incision was made into the ham.

The principle, respecting the application of a ligature to each end of every large divided artery, is to be extended also to punctured arteries, one ligature being placed above, and the other below, the opening in the vessel.

From some observations, introduced in the article *Aneurism*, p. 150, it will be seen, that, when the impulse of the circulation has been lessened by the ligature of the main trunk of an artery, some distance above the wound, the hemorrhage from the more remote portion of the vessel, may sometimes be effectually restrained by pressure, which, previously to the stoppage of one great current of blood to the part, had proved unavailing. This fact is worth remembering in cases, in which the arteries of the hand, or foot, are wounded.

Mortification is observed to be more frequent after the ligature of an artery for a wound, than for an aneurism. In wounds, Mr. Hodgson very correctly, I think, refers the difference to the frequent injury of the surrounding parts, and particularly of the veins and nerves, and to the loss of blood, and want of quietude, and proper care after the accident. The principal anastomosing vessels are also sometimes divided. (P. 479.)

Having given in the article *Aneurism*, the necessary directions, how to cut down to and tie many of the principal arteries, I shall conclude the present subject with a few instructions how to take up the arteries of the fore-arm and leg, as explained by Scarpa, Mr. C. Bell, Mr. Hodgson, and others. Some directions how to act in a case of wounded axillary artery are likewise subjoined.

In order to lay bare the radial artery at the upper third of the fore-arm, a finger is to be put on the insertion of the tendon of the biceps. A little below this insertion, an incision, about two inches and a half in length, is to be made in the integuments, in the oblique direction, denoted by the inner edge of the supinator radii longus. The subjacent fascia is then to be divided, and the inner edge of the supinator muscle drawn a little from the outer side of the arm: in the space, between that muscle and the flexor carpi radialis, the radial artery immediately presents itself, passing over the tendon of the pronator radii teres, and the flexor longus pollicis, and it then runs down between the latter named tendon and the flexor carpi radialis. (See *Camper's Anat. Demonstr. Pathol. Lib. 1, Tab. 1, fig. 2.*) A branch of the musculo-spiral nerve lies on the radial side of the artery.

At the wrist, the radial artery may be taken up by making an incision a little way from the radial margin of the flexor carpi

ulnaris. Here the artery is covered by a fascia, over which a small branch of the external cutaneous nerve runs; but the vessel is now unaccompanied with the musculo-spiral nerve, which quits it, and passes under the supinator radii longus, a little below the middle of the fore-arm.

After the radial artery leaves the fore part of the wrist, it may be taken up by making an incision "on the outside of the insertion of the extensor primi internodii pollicis, and the inside of the extensor tertii internodii pollicis. Betwixt these tendons, the artery lies very deep, and over it is the extreme branch of the muscular spiral nerve. We find the artery going close to the notch, betwixt the os scaphoides and trapezium." (C. Bell, *Op. Surgery*, V. 2, p. 373.)

For bringing into view the ulnar artery at the upper third of the fore-arm, the situation and breadth of the flexor carpi ulnaris muscle must first be ascertained. An incision is then to be made from above downwards, beginning two inches below the inner condyle of the humerus, and following the course of the inner margin of the above muscle to the extent of two inches and a half. The fascia is then to be divided: the flexor carpi ulnaris is to be drawn a little away from the flexor digitorum sublimis. In this opening, rather under the margin of the latter muscle, the ulnar artery will be felt with the finger, continuing its course over the flexor profundus. The ulnar nerve is situated on the ulnar side of the artery.

Below the middle of the fore-arm, the ulnar artery is more superficial, and may easily be taken up by making an incision upon the radial side of the flexor carpi ulnaris, between the tendon of which muscle, and that of the flexor profundus digitorum, the vessel is situated. The artery, however, will not be reached until a thin aponeurosis under the fascia of the fore-arm has been divided. The nerve is rather more under the tendon of the flexor carpi ulnaris, than the artery. When the ulnar artery arises from the brachial above the elbow, it runs above the fascia, and is easily taken up at any part of its course.

The anterior tibial artery passes forward between the bones of the leg, about an inch below the upper head of the fibula. In order to take up the vessel in this situation, a free cut must be made through the fascia, extended between the heads of the tibia and fibula. The incision is then to be continued more deeply at the edge of the peronæus longus, following the fascia between this muscle and the origin of the extensor digitorum communis. The artery will be met with on the interosseous ligament. (C. Bell, V. 2, p. 376.)

In order to lay bare the anterior tibial artery, a little above the middle of the leg, the finger is to be passed along the outer side of the spine of the tibia, and the breadth of the tibialis anticus muscle is to be ascertained. Along the outer margin of this muscle, an incision is to be made

through the integuments and fascia, two inches and a half in length. The knife is then to be introduced between the outer margin of the tibialis anticus muscle, and the extensor longus of the great toe. In this space, at the depth of about an inch, the anterior tibial artery is situated. (See *Haller's Icon. Anat. Fasc. 5, Tab. 4.*) Cutting down to this artery, near the tarsus, where the vessel passes out between the tendons of the tibialis anticus and extensor muscle of the toes, is an easy operation.

The laying bare of the posterior tibial artery, behind the malleolus internus, is also quite easy: an incision, about two inches long, is to be made between the internal malleolus, and the tendo Achillis, down to the posterior surface of the tuberosity of the tibia. At this depth, the tendon of the tibialis posticus muscle, and that of the flexor communis digitorum pedis, run, as in a furrow. Along with these two tendons, but a little nearer to the os calcis, the posterior tibial artery descends to the sole of the foot.

On the contrary, the depth of the posterior tibial artery at the middle, or in the upper third of the leg, makes it very difficult to take up the vessel in these situations. And the difficulties are increased by the spasmodic contractions of the gastrocnemius and soleus muscles. When necessary, however, the artery may be exposed and tied above and below the wound in it, by proceeding as follows: an incision is to be made, three or four inches in length, along the inner side of the crest of the tibia, and the origins of the soleus muscle are to be detached from it to the same extent, and reflected. Under the soleus muscle is found the aponeurosis, which separates the muscles of the calf of the leg into superficial and deep seated. When this fascia has also been divided, the posterior tibial artery may be seen, or felt deeply situated, running on the tibialis posticus and flexor muscle of the toes. (See *Haller, Icon. Anat. Fasc. 5, Tab. 5.*)

In taking up the axillary artery, when it is wounded, Scarpa believes, that nothing tends more to embarrass the surgeon, than an injudicious smallness of the first incision through the skin and such other parts as conceal the wound in the artery. An assistant must compress the vessel, from above the clavicle, as it passes over the first rib. When the weapon has penetrated, from below upward, directly into the axilla, the surgeon is to make a free dilatation of the wound upon a director, or his finger. This must be done to a sufficient height to expose a considerable portion of the artery, and the precise situation of the wound in it.

When the weapon has pierced obliquely, or from above downwards, through a portion of the great pectoral muscle, into the axilla, Scarpa advises the surgeon to cut through the lower edge of this muscle, and enlarge the wound, on a director, or his finger, so as to bring fairly into view the injured part of the artery. The thoracic arteries, divided in this operation, must be immediately tied. The clots of blood are then to be removed, and the bottom of the wound cleaned with a sponge, by which means the opening in the axillary artery will be more clearly seen. As this vessel lies imbedded in the brachial plexus of nerves, the surgeon must take care to raise it from these latter parts with a pair of forceps, before he ties it. Two ligatures will be required: one above; the other below the wound of the artery.

ASTRINGENTS. (from *astringo*, to bind.) In medicine, are those substances which possess a power of making the living fibres become contracted, condensed, and corrugated. They are employed in the practice of surgery chiefly as external applications, either for restoring diminished tonic power, or checking various discharges. Astringent lotions are usually deemed eligible local remedies for phlegmonous inflammation.

ATHEROMA. (from *αθηρα*, pap.) An encysted tumour, so named from its pap-like contents. (See *Tumours Encysted.*)

B.

BALSAMUM COPAIVÆ. Exhibited by surgeons principally in cases of gonorrhea, gleet, and piles: The common dose is from ten to thirty drops, two or three times a day.

BALSAMUM PERUVIANUM CUM FELLE BOVINO. ℞ Fellis Bovini ℥iij. Balsami Peruv. ℥j. M. Dr. H. Smith recommended this application to be occasionally dropped into the ear, when there is a fetid discharge from the meatus auditorius. This passage is also to be washed out every day, by throwing into it with a syringe warm water alone, or containing a little soap.

BANDAGE. (*Deligatio. Fascia.*)

The use of bandages is to keep dressings, compresses, remedies, &c. in their proper situation; to compress blood-vessels, so as to restrain hemorrhage; to rectify certain deformities by holding the deranged parts in a natural position; and to unite parts, in which there is a solution of continuity. As the application of bandages is an important branch of surgery, authors have not neglected it. Much has been written on the subject, and almost every writer has devised new bandages, perhaps without much benefit to the art. Unfortunately, it is next to impossible to give very clear ideas of the numerous sorts of bandages by a printed descrip-

tion of them. The surgeon can only acquire all the necessary instruction and information from the experience and habit resulting from practice. Hence, we shall confine ourselves to a general account of the subject.

Bandages should be made of such materials, as possess sufficient strength to fulfil the end proposed in applying them, and at the same time, they should be supple enough to admit of being accommodated to the parts, to which they are applied.

Bandages are made of linen, cotton, or flannel. If possible, they should be without a seam, or selvaige, which sometimes causes unequal and painful pressure.

There are cases, in which the bandage should have a degree of firmness, that does not belong to the materials usually employed. This circumstance is obvious in cases of hernia, and in all those examples, in which there is occasion for elastic bandages. As we have already observed, linen, flannel, and cotton (calico,) are the common materials. The first employment of flannel bandages is imputed to the Scotch surgeons, who preferred them to linen ones, in consequence of their being better calculated for absorbing moisture, while, being more elastic, they yield in a greater degree in cases requiring this property; as in the swelling subsequent to dislocations, fractures, &c. It has been asserted, that linen is better than flannel, because more cleanly; but neither one nor the other will continue clean, unless care be taken to change it often enough. Where the indication is to keep the parts warm, flannel is of course preferable to linen or calico.

The employment of cotton or calico bandages is a more recent method, and many advantages are attributed to the softness and elasticity of this material.

In applying a bandage, care must be taken, that it be put on tight enough to fulfil the object in view, without running any risk of stopping the circulation, or doing harm in any other way. If it be not sufficiently tight to support the parts in a proper manner, it is useless; if it be too tense, it will produce swelling, inflammation, and even mortification.

In order to apply a roller skilfully, the part which is to be covered, must be put in its proper situation; the head of the roller held in the surgeon's hand, and only so much unrolled, as is necessary for the commencement of the application.

In general, the bandage should be applied in such a manner, as will admit of its being removed with the most ease, and allow the state of the subjacent parts to be examined, as often as occasion may require.

For this reason, in fractures of the leg and thigh, the eighteen-tailed bandage is generally preferred to a simple roller. The former may be loosened and tightened, at pleasure, without occasioning the smallest disturbance of the affected limb; a thing

which could not be done, were a common roller to be employed.

As soon as a bandage has fulfilled the object for which it is applied, and it has become useless, its employment should be discontinued; for, by remaining too long on parts, it may obstruct the circulation, diminish the tone of the compressed fibres and vessels, and thus do harm.

Bandages are either *simple* or *compound*. They are also sometimes divided into general and *particular*. The latter often derive their names from the parts to which they are usually applied.

A simple bandage is a long piece of linen or cotton, of an indefinite length, and from three to six inches in breadth. When about to be applied, it is commonly rolled up, and the rolled part is termed its *head*. When rolled up from each end, it is called a *double-headed roller* or *bandage*.

The chief of the simple bandages are the *circular*, the *spiral*, the *uniting*, the *retaining*, the *expellent*, and the *creeping*.

The *circular* bandage is the simplest; consisting merely of a few circles of a roller covering, or overlapping each other.

The *spiral* bandage is the most frequently used of all; for, it is this, which is seen in such common employment on the limbs, in cases of ulcers, varices, &c. In applying a common roller to the whole of a limb, the bandage must be carried round the part spirally; for otherwise the whole member cannot be covered. When the leg is the part, the surgeon is to begin by surrounding the foot with a few turns. Then carrying the head of the bandage over the instep, he is to convey it backward, so as to make the bandage unroll, and apply itself just above the heel. The roller may next be brought over the inner ankle; thence again over the instep, and under the sole; and the surgeon then brings the bandage spirally upward once more to the outer part of the leg. After this, every circle of the roller is to be applied, so as to ascend up the limb in a gradual, spiral form, and so as to cover about one-third of the turn of the roller immediately below it. The increasing and diminishing diameter of the limb, is one great cause, which brings into view the unskilfulness of a surgeon in this common operation; for, it prevents the roller from lying smoothly although spirally applied, unless a particular artifice be dexterously adopted. The plan alluded to, is to double back the part of the roller that would not be even, were the application to be continued in the common spiral way, without this manœuvre. When the bulk of the limb increases very suddenly, it is sometimes necessary to fold, or, as it is termed, *reverse*, every circle of the bandage in the above manner, in order to make it lie evenly on the limb. It is manifest, that the pressure of the roller will be greatest where the duplicatures are situated, and hence, when it is an object to compress any particular part, the surgeon should contrive to

reverse the turns of the bandage just over the situation where most pressure is desirable.

When a roller is to be applied to the fore-arm, it is best to make the few first turns of the bandage round the hand.

Care must be taken not to make the bandage very tight, if it be intended to wet it afterwards with any lotion ; for it is always rendered still more tense by moisture.

Mr. John Bell describes the principal purposes for which a roller is employed, as follows : " Although in recent wounds, it is with plasters and sutures that we unite the parts point to point, yet it is with the bandage that we support the limb, preserve the parts in continual and perfect contact with each other, and prevent any strain upon the sutures, with which the parts are immediately joined, and we often unite parts by the bandage alone. (This is called the *Uniting Bandage*, and will be presently described.) But it is particularly to be observed, that in gun-shot wounds, and other bruised wounds, though it would be imprudent to sew the parts, since it is impossible that they should altogether unite, yet the gentle and general support which we give by a compress and bandage, prevents them from separating far from each other, unites the deep parts early, and lessens the extent of that surface, which must naturally fall into suppuration.

" In the hemorrhagy of wounds, we cannot always find the artery ; we dare not always cut parts for fear of greater dangers ; we are often alarmed with bleedings from uncertain vessels, &c. or from veins as well as arteries : these hemorrhages are to be suppressed by the compress ; which compress, or even the sponge itself, is but an instrument of compression, serving to give the bandage its perfect effect. Frequently, in bleedings near the groin, or the arm-pit, or the angle of the jaw, wherever the bleeding is rapid, the vessels uncertain, the cavity deep, and the blood not to be commanded by a tourniquet, and where the circumstances forbid a deliberate and sure operation, we trust to compress and bandage alone.

" Bandage is very powerful in suppressing bleeding. At one period of surgery, it took place of every other method, &c. If a compress be neatly put upon the bleeding arteries, if there be a bone to resist the compress, or even if the soft parts be firm below, and the bandage be well rolled, the patient is almost secure. But such a roller must be rolled smoothly from the very extremity of the fingers or toes ; the member must be thoroughly supported in all its lower parts, that it may bear the pressure above. It is partial stricture alone that does harm, creates intolerable pain and anxiety, or brings on gangrene. Hemorrhagy requires a very powerful compression, which must therefore be very general, &c. It must not be made only over the bleeding arteries, which is all that the surgeon thinks of in general, &c.

" In abscesses, where matter is working downwards along the limb, seeking out, as it were, the weak parts, undermining the skin, and wasting it, insulating and surrounding the muscles, and penetrating to the bones, the bandage does every thing. The expelling bandage, the propelling bandage, the defensive bandage, were among the names, which the older surgeons gave to the roller, when it was applied for these particular purposes ; and these are properties of the roller, which should not be forgotten." (*Principles of Surgery, Vol. 1.*)

Soon after this description of some of the chief surgical uses of the roller, Mr. John Bell proceeds to explain, in what manner this most simple of all bandages may be put on a limb.

" Practice will convince you, that the firmness and neatness of a bandage depend altogether upon these two points ; first, upon the turns succeeding each other in a regular proportion ; and, secondly, upon making reverses, wherever you find any slackness likely to arise from the varying form of the limb. Thus, in rolling from the foot to the ankle, leg, and knee, you must take care, first, that the turns, or as the French call them, *doloires*, of the roller lie over one another by just one-third of the breadth of the bandage ; and secondly, that at every difficult part, as over a joint, you turn the roller in your hand, make an angle, and lay the roller upon the limb, with the opposite flat side towards it ; you must turn the bandage so as to reverse it, making, what the French call, a *renversee* of the roller at the ankle, at the calf of the leg, and at the knee. You must be careful to roll your bandage from below upwards, and support the whole limb by a general pressure. That you may be able to support the diseased part with a particular pressure, you must lay compresses upon the hollows and upon the bed of each particular abscess, and change the place of these compresses from time to time, so as now to prevent matter sinking into a particular hollow, now to press it out from a place where it is already lodged, and again to reunite the surface of an abscess already completely formed, from which the matter has been discharged." (*Principles of Surgery, Vol. 1.*)

In the article *Joints*, we have taken notice of the good effects of the pressure of the roller in the cure of some diseases of the knee. Here we shall just introduce Mr. John Bell's sentiments upon the subject : " In a diseased bursa, as in a relaxation of the knee-joint, that disease, which, with but a little indulgence, a very little encouragement of fomentations, poultices, bleeding, and low diet, would end in white-swelling of the knee, may be stopped even by so simple a matter as a well-rolled bandage. (*Vol. 1, p. 127.*)

The *uniting bandage*, or *spica descendens*, used in rectilinear wounds, consists of a double-headed roller, with a longitudinal slit in the middle, of three or four inches long. The roller, having one head passed

through the slit, enables the surgeon to draw the lips of the wound together. The whole must be managed, so that the bandage may act equally. When the wounds are stitched, this bandage supports the stitches, and prevents their tearing through the skin. When the wound is deep, writers advise a compress to be applied on each side, in order to press the deeper part of its sides together. When the wound is very long, two or three bandages should be employed, and great care must be taken, that the pressure is perfectly equable.

Hienkel and Richter recommend an uniting bandage, which allows the surgeon to see the wound, over which only narrow tapes cross. The reader, if he should ever wish to employ this contrivance, may read a description of it in Rees's Cyclopædia, or Motherby's Medical Dictionary; though I confess I could not understand it from the description in those works, until I looked at the plate in Richter's *Anfangsgr. der Wundarzn.* Band 1.

When we make use of a single-headed roller, as a *retentive bandage* only, we should always remember to begin the application of it on the side opposite the wound. The obvious reason for so doing is to prevent a farther separation of the lips of the wound, as the contrary manner of applying the roller would tend directly to divide them. (*Gooch, Vol. 1, p. 143.*)

The intention of the *expellent bandage* is to keep the discharge sufficiently near the orifice of the wound to prevent the formation of sinuses. In general, a compress of unequal thickness is necessary; the thinner part of the compress being placed next, and immediately contiguous to, the orifice of the wound; the thicker part below. Before the bandage is applied, the pus must be completely pressed out, and the rolling begin with two, or three, circular turns on the lower part of the compress. The bandage must then be carried spirally upwards, but not quite so tightly, as below. It is afterwards to be rolled downward to the place where it began.

The *creeping* is a simple bandage, every succeeding turn of which only just covers the edge of the preceding one. It is employed in cases, in which the object is merely to secure the dressings, and not to make any considerable, or equable pressure.

A bandage is termed *compound*, when several pieces of linen, cotton, or flannel, are sewed together in different directions, or when the bandage is torn or cut, so as to have several tails. Such are the T bandage, the suspensory, the capistrum, &c.

The *eighteen-tailed bandage* is one of the most compound. It is now in general use for all fractures of the leg and thigh, sometimes for those of the fore-arm, and frequently, for particular wounds. Its great recommendations are the facility with which it can be undone, so as to allow the parts to be examined, and its not creating,

on such an occasion, the smallest disturbance of the disease, or accident.

The eighteen-tailed bandage is made by a longitudinal portion of a common roller, and by a sufficient number of transverse pieces, or tails, to cover as much of the part as is requisite.

Each of the cross pieces is to be proportioned in length to the circumference of the part of the limb to which it is to be applied; so that in making this sort of bandage for the leg, or thigh, the upper tails will be twice as long as the lower ones. After laying the long part of the bandage on a table, fix the upper end of it in some way or another. Then begin laying the upper tails across it, and proceed with placing the rest. Each tail must be long enough to extend about two inches beyond the opposite one, when they are both applied. The tails, being all arranged across the longitudinal band, they are to be stitched in this position with a needle and thread. When the bandage is intended for the leg, a piece of the longitudinal part of the roller below, is to extend beyond the tails. This is usually brought under the sole of the foot, and then applied over the inner ankle in the first instance, after the bandage has been put under the limb. Then the surgeon lays down the first of the lower tails, and covers it with the next one above. In this way, he proceeds upward, till all the cross pieces are applied, the uppermost one of which he fastens with a pin. This bandage has a very neat appearance. The tails are said to lie better, when placed across the longitudinal piece a little obliquely. (*Pott.*)

The T bandage is, for the most part, used for covering parts of the abdomen and back; and especially, the scrotum, perinæum, and parts about the anus. Its name is derived from its resemblance to the letter T, and it is, as Mr. John Bell remarks, the peculiar bandage of the body. If the breast or belly be wounded, we make the transverse piece, which encircles the body, very broad, and having split the tail-part into two portions, one of these is to be conveyed over each side of the neck, and pinned to the opposite part of the circular bandage, so as to form a suspensory for the latter, and prevent its slipping down. But, says Mr. John Bell, if we have a wound, or disease, or operation, near the groin, or private parts, the tail-part then becomes the most important part of the bandage: then the transverse piece, which is to encircle the pelvis, is smaller, while the tail-part is made very broad. When the disease is in the private parts, perinæum, or anus, we often split the tail according to circumstances; but, when the disease is in one groin, we generally leave the tail-part of the bandage entire and broad.

The *linterum scissum*, or *split-cloth*, is a bandage applied occasionally to the head, and consists of a central part, and six, or eight tails, or heads, which are applied as follows:

When the cloth has six heads, the middle, or unsplit part of the cloth is applied to the top of the head. The two front tails go round the temples, and are pinned at the occiput; the two back tails go also round the temples, and are pinned over the forehead; the two middle tails are usually directed to be tied under the chin; but, as Mr. John Bell observes, this suffocates and heats the patient, and it is better to tie them over the top of the head, or obliquely, so as to make pressure upon any particular point. (*Principles of Surgery, Vol. 1. p. 131.*)

The old surgeons usually split this middle tail into two parts, a broad, and narrow one. In the broad one, they made a hole to let the ear pass through. This broad portion was tied under the chin, while the narrow ends were tied obliquely over the head. As Mr. John Bell has observed, though this gave the split-cloth the effect of eight tails, yet, the ancient surgeons did not name it the split-cloth with eight tails. When they split the cloth into eight tails, and, especially, when they tied the eight tails in the following particular manner, they called the bandage *cancer*, as resembling a crab in the number of its legs. The *cancer* or *split-cloth of eight tails*, was laid over the head, in such a manner, that four tails hung over the forehead and eyes, while the other four hung over the back of the head. They were tied as follows; first, the two outermost tails, on each side in front, were tied over the forehead, while the two middle tails in front were left hanging over the knot. Then the two outermost, or lateral tails behind, were tied round the occiput. Next the middle tails were tied, the two anterior ones being made to cross over each other, and pass round the temples to be pinned at the occiput; while the two middle tails behind, were made to cross each other, and pass round the temples, so as to be pinned over the ears, or near the forehead. (See *John Bell's Principles, Vol. 1. p. 132.*)

The *triangular bandage* is generally a handkerchief doubled in that form. It is commonly used on the head, and now and then, as a support to the testicles, when swelled. The French term it *couvre-chef en triangle*.

The *nodose bandage*, called also *scapha*, is a double-headed roller, made of a fillet four yards long, and about an inch and a half broad. It must be reversed two or three times, so as to form a knot upon the part which is to be compressed. It is employed, when a hemorrhage from a wound is to be stopped, or, for securing the compress, after bleeding in the temporal artery. The most convenient bandage in general for the forehead, face, and jaws, is the *four-tailed one*, or *single split-cloth*.

It is composed of a strip of cloth, about four inches wide, which is to be torn at each end, so as to leave only a convenient portion of the middle part entire. This unsplit middle portion is to be applied to the forehead, if the wound be there, and the two upper tails are carried backward, and

tied over the back part of the head, while the two lower ones are to be tied either over the top of the head, or under the chin, as may seem most convenient.

When the wound is on the top of the head, the middle of the undivided part is to be applied to the dressings. The two posterior tails are to be tied forward, and the two anterior ones are to be carried backward, so as to be tied behind the head. This is sometimes called *Galen's bandage*. It is curious, that writers on bandages should use the terms *head*, and *tail*, synonymously, and hence this *four-tailed bandage* is often called the *sling* with *four heads*. Such confusion of language is highly reprehensible, as it contributes, in a very high degree, to obstruct the comprehension of any, the most simple subject.

If the upper lip be cut, and a bandage needed, which is seldom the case, it is almost superfluous to say, that this bandage will serve the purpose. It serves also in cuts of the lower lip, though there, also, we trust rather to the twisted suture, than a bandage.

The single split-cloth is particularly useful in supporting a fractured lower jaw, and in such cases, is the only one employed in modern surgery. This bandage, when used for this particular purpose, namely, supporting the lower jaw, is named *capistrum*, or *bridle*, because it goes round the part somewhat like a horse's halter.

"In some cases, (says Mr. John Bell) the circumstances require us to support the chin particularly, and then the unsplit part of the bandage is applied upon the chin with a small hole to receive the point; but, where the jaw is broken, we pad up the jaw-bone into its right shape, with compresses pressed in under the jaw, and secured by this bandage. When we are in fear of hemorrhagy after any wound, or operation, near the angle of the jaw, we can give the sling a very remarkable degree of firmness. For this purpose, we tear the band into three tails on each side, and we stitch the bandages at the bottom of each slit, lest it should give way, when drawn firm," &c. (*Principles of Surgery, Vol. 1.*)

We have already described one way of applying a handkerchief, as a bandage to the head, when we noticed the *triangular one*, or *couvre-chef en triangle*. The other manner of applying the handkerchief, called the *grand couvre-chef*, is as follows;

You take a large handkerchief, and fold it, not in a triangular, but a square form. You let one edge project about three finger-breadths beyond the other, in order to form a general border for the bandage. You lay the handkerchief upon the head, so as to make the lower fold, to which the projecting border belongs, lie next the head; while the projecting border itself is left hanging over the eyes, till the bandage is adjusted. The two corners of the outermost fold are first to be tied under the chin; the projecting border is then to be turned back, and pinned in a circular form round the face.

while the corners of the fold next the head are to be carried backward and tied.

After the outer corners of this bandage have been tied under the chin; after the inner corners have been drawn out and carried round the occiput; and after the border has been turned back and pinned; the doubling of the handkerchief over each side of the neck hangs in a loose awkward manner. It remains, therefore, to pin this part of the handkerchief up above the ear, as neatly as can be contrived. (See *J. Bell's Principles*.)

The grand couvre-chef has certainly nothing to recommend it, either in point of utility or elegance. A common night-cap must always be infinitely preferable to it. In the event, however, of a cap not being at hand, it is proper that the surgeon should know, what contrivances may be substituted to fulfil the objects in view.

Having, in the numerous articles of this Dictionary, noticed the mode of applying bandages in particular cases, and allotted a few separate descriptions for such bandages, as are not here mentioned, but which are often spoken of in books, we shall conclude for the present, with referring the reader for further information to *Motherby's Medical Dictionary*; *Rees's Cyclopædia*; and *John Bell's Principles of Surgery*, Vol. 1. *Galen and Vidus Vidius* are reckoned the best of the old writers on the subject; *M. Sue*, *Thillaye*, *Heister*, *Juville*, *Lombard*, and *Bernstein*, of the modern ones. The latter are said however, to be all too prolix. (See *Rees's Cyclopædia*, art. *Bandage*.)

BARK, *Peruvian*, (See *Cinchona*.)

BELLADONNA. (*Deadly Night-shade*.) Is violently narcotic. The leaves were first used externally for discussing scirrhus swellings, and they have been subsequently given internally, in scirrhus and cancerous diseases, amaurosis, &c. Five grains are reckoned a powerful dose: one is accounted enough to begin with. At present, the extract, as directed by the London College, is more commonly prescribed.

From the power, which belladonna is known to possess, of lowering the action of the whole arterial system, it seems to be a fit medicine in many surgical cases, where that object is desirable, particularly in examples of aneurism.

A very peculiar virtue, which belladonna has, is that of causing a dilatation of the pupil, when used as an external application to the eyebrow and eyelids. The late Mr. Saunders was in the habit of employing belladonna a good deal for this express purpose. A little while before undertaking the operation for the congenital cataract, he was accustomed to introduce some dissolved extract of belladonna between the eyelids, or rub the eyebrow and skin about the eye freely with the same application. The consequence was, that if there were no adhesions of the iris to other parts, a full dilatation of the pupil was produced in less than an hour, and the whole of the ca-

taract was distinctly brought into view. This was unquestionably a considerable improvement in practice, as the iris was kept out of danger, and the operation materially facilitated. I allude here more particularly to Mr. Saunders's own method, in which he introduced the needle through the cornea, in front of the iris, and then conveyed it to the cataract through the enlarged pupil. Belladonna was also externally applied by Mr. Saunders, after the operation, with the view of preventing the edge of the iris from becoming adherent to the edges of the torn capsule. Stramonium is found to have the same effect upon the iris, as belladonna. Some experiments, in which the fact is clearly proved, were detailed many years ago, by a namesake of my own in the United States. (See *A Dissertation on the Properties and Effects of the Datura Stramonium*, &c. by Samuel Cooper, Philadelphia, 1797. *C. Himly de la Paralysie de l'Iris par une application local de Jusquiame*, &c. 2d Ed. 12mo. Altona, 1805. *J. Bailey, Observations relative to the Use of Belladonna in painful Disorders of the Head and Face*, 8vo. Lond. 1818.)

BINOCULUS. (from *binus*, double, and *oculus*, the eye.) A bandage for keeping dressings on both eyes. Its application will easily be understood by referring to *Monoculus*.

BISTOURY. (*Bistoir*, French.) Any small knife for surgical purposes.

BLADDER, *Puncture of*. This is an operation, to which we are obliged to have recourse, after having in vain employed all the other means indicated for preventing the bad, and even fatal consequences of a stoppage of the evacuation of the urine, and distention of the bladder. Various accidents and diseases, both acute and chronic, may occasion this dangerous state, as will be more particularly noticed in the article *Urine, retention of*.

The bladder, which can conveniently hold about a pint and a half of urine, is no sooner dilated, so as to contain two pints, than uneasy sensations are experienced. The desire of discharging the water now becomes urgent, and if the inclination be not gratified, and the bladder be suffered to be dilated beyond its natural state, it loses all power of contraction, and becomes paralytic. The desire, indeed, continues, and the efforts are renewed in painful paroxysms; but, the power is lost and the bladder becomes more and more distended. When this viscus is dilated in the utmost degree, and neither its own structure, nor the space in the abdomen, can allow a further distention; either the bladder must be lacerated, which it never is, so equally is it supported by the pressure of the surrounding parts, or its orifice must expand and the urine begin to flow. After the third day of the retention, the urine often really begins to flow, and, whatever descends from the kidneys is evacuated in small quantities from time to time, and at this period, the bladder is distended in as great a degree, as

it ever can be, however long the patient may survive. This dribbling of the urine, which begins, when the bladder is dilated to the utmost, and continues till the eighth, or tenth day, or till the bladder sloughs, has long been understood, and is named by the French, "*urine par regorgement.*" To practitioners, who do not understand it, the occurrence is most deceitful. The friends felicitate themselves, that the urine begins to flow; the surgeon believes it; basins, and cloths, wet with urine, are easily produced; but, the patient lies unrelieved. The continued distention of the bladder is followed by universal inflammation of the abdomen. The insensibility, and low delirium of incipient gangrene, are mistaken for that relief, which was expected from the flow of urine, till either hiccough comes on, and the patient dies of fever, and inflammation, or the urine gets into the abdomen, through an aperture, formed by mortification. Let no surgeon, therefore, trust to the reports of nurses, and friends, but lay his hand upon the hypogastric region, and tap with his finger, in order that he may distinguish the distended bladder, and the fluctuation of urine. As the bladder suffers no further distention, after the third day, why should it burst? Not from laceration; for it is supported by the uniform pressure of the surrounding viscera; not by yielding suddenly, for it is distended to its utmost on the third day of the retention, and yet seldom gives way before the tenth; not by attenuation, for it becomes thickened. The term laceration was never more wrongly applied, than in this instance; for, when there is a breach in the bladder, it is found, on dissection, to be a small round hole, such as might be covered with the point of the finger. The rest of the viscus, and the adjacent bowels, are red and inflamed, while this single point is black, and mortified! Delay is more dangerous, than even the worst modes of making an opening into the bladder, and, while life exists, the patient should have his chance. (See *John Bell's Principles of Surgery*, Vol. 2, Part 1, p. 262, &c.)

That many patients die after paracentesis of the bladder is an undoubted truth, and this circumstance has rather intimidated practitioners against the operation. It appears to me, however, that death may in general be more fairly ascribed to the effects of the disease, than to the puncture of the bladder, and that, if this last measure were not deferred so long, as it often is, the recoveries would be more numerous.

Hence, when relief cannot be obtained by the treatment described in the article, *Urine, Retention of*; when no urine at all has come away, at the end of the third day; or when it only does so in a dribbling manner after this period, while the bladder continues distended, and no catheter can be introduced; the operation should not be delayed. In urgent cases, one should rather operate, as soon as forty-eight hours have elapsed.

No doubt, a man, who is exceedingly skilful in the use of the catheter, and knows how to practise with science and judgment all the other means for relieving the retention of urine, will not frequently find it necessary to have recourse to the operation of puncturing the bladder. This is said to have been so much the case with the eminent Desault, that, in the course of ten years, he had occasion only once to perform such an operation in the Hotel Dieu, where diseases of the urethra are always extremely numerous. (See *Œuvres Chir. de Desault*, par Bichat, Tom. 2, p. 316.) When, however, this superior manual dexterity with the catheter is not the acquirement of the practitioner, the timely performance of the paracentesis of the bladder should ever be observed. At the present day, the absolute necessity for puncturing the bladder is also rendered a less frequent circumstance, not only by the treatment of diseases of the urethra being better understood, than formerly, but also by the very great perfection, to which the construction of elastic gum catheters is brought, instruments, from which the most essential assistance may frequently be derived. I shall next treat of the three modes of doing the operation.

1. Puncture through the Perinæum.

The first surgeon that ever performed this operation is said to have been M. Tolet, a French surgeon, the author of a valuable treatise, entitled "*Traité de Lithotomie, ou de l'extraction de la pierre hors de la vessie*, Troisième édition, Paris, 1681." According to Sabatier, it was customary, at the time of Dionis, to make the opening with a narrow-pointed scalpel, about four or five inches long, which was plunged into the bladder, at the place where the incision in the apparatus major terminated. (See *Lithotomy*.) The escape of the urine indicated when the surgeon had reached the bladder. A straight probe was conducted along the knife, and then a cannula was passed along the probe into the bladder, where it was allowed to remain as long as necessary, care being taken to fix it by means of tapes, put through the rings at the broad part of the instruments. The opening was then closed with a linen tent. Some practitioners, however, after introducing a staff as far into the urethra as possible, began an incision in the perineum. Having made an opening into the canal, they pushed the staff into the bladder, and along this instrument introduced a gorget. With the assistance of the gorget, a cannula was next passed into the bladder, and allowed to continue thus introduced. This complicated mode of proceeding, which Sabatier is pleased to term more methodical than that which has been first mentioned, could only answer in cases, where the obstruction about the neck of the bladder was inconsiderable, and where in fact the introduction of the catheter was not yet impracticable. At least, therefore, the me-

thod was unnecessary. The other plan of piercing the urethra in several places, and making a passage for the urine through the prostate, says Sabatier, increased the inflammation, with which this gland was affected, and rendered the disease, if not mortal, at least much more difficult of cure.

Sabatier represents Dionis as the first who suggested this method of opening the bladder on one side of the perineum, at the part, where Frère Jacques used to perform lithotomy. Dionis conceived, that in this mode of operating, the patient would suffer less pain, because neither the urethra, nor the neck of the bladder, would be injured; but at the same time, he recommended a process to be followed, which was similar to that pursued in making the puncture in the middle of the perineum; viz. that a narrow scalpel should first be introduced, so as to make a passage for the probe, along which the cannula was to be guided into the bladder. The idea of substituting for these unsuitable instruments a trocar of convenient length, was exceedingly simple, and for this improvement, which took place in 1721, surgery is indebted to Juncker, (See *Conspectus Chirurgia*, Tab. 97, p. 674,) unless the following passage be correct: "In the year 1717, or 1718, M. Peyronie showed in the King's garden a long trocar, which he had successfully employed in a similar puncture." (*Desault's Parisian Chir. Journ.* Vol. 2, p. 267.)

The patient having been placed in the same position as for lithotomy, an assistant is to press with his left hand on the region of the bladder, above the pubes, in order to propel that viscus as far downward into the lesser pelvis as possible, while, with his right hand, he supports the scrotum. The surgeon is then to introduce the trocar at the middle of a line, drawn from the tuberosity of the ischium to the raphe of the perineum, two lines more forward than the verge of the anus. The instrument is first to be pushed in a direction parallel to the axis of the body; and its point is afterwards to be turned a little inwards. Here, according to Bichat, there is no occasion to convey the cannula so far into the bladder, as is done, when the operation is performed above the pubes. The portion of this viscus, that is pierced, being incapable of changing its position, with regard to other parts in the perineum, if the cannula only project a few lines into its cavity, it will not be liable to slip out. It would be wrong, indeed, to carry it in further; for, the pressure of its end against the posterior parietes of the bladder would do harm. Lastly, the cannula is to be fixed in its place, by means of the T bandage. (See *Œuvres Chir. de Desault*, T. 3, p. 320.)

Some writers recommend the introduction of the left index finger into the rectum, in order to draw this intestine out of the way; but Sabatier thinks it better to use this finger for pressing on the part of the perineum, where the puncture is about to be made, so as to make the skin tense, and

assist in the guidance of the trocar. (*Médecine Opératoire*, T. 2, p. 126.)

The parts, divided in the puncture, are the skin, a good deal of fat, and cellular substance, the levator ani muscle, and that portion of the lower part of the bladder, which is situated on one side of its neck.

The following is the judgment, which Bichat has passed upon this method: In the track, which the trocar has to pass, there is no part, the puncture of which must of necessity give rise to bad symptoms. A surgeon, moderately exercised in the practice of this operation, is tolerably sure of piercing the bladder, which is opened in the most depending situation, and at a point, which constantly bears the same relation to the perinæum. But, the position, in which the patient is placed for the operation, is a great deal more disagreeable, than that for the puncture above the pubes. Several assistants are required to fix him, and one is necessary for compressing the bladder in the hypogastric region. There is a possibility of wounding the vessels of the perineum, and of pricking the nerves which accompany them. If the point of the trocar be carried too much outwards, it may glide over the external side of the bladder. If it be inclined forwards, it may slip between this viscus and the pubes. If it be turned too much inwards, it may pierce the prostate gland. If directed too much backwards, it may wound the vasa deferentia, the rectum, the extremity of the ureter, and the vesiculæ seminales. Also, while the cannula is kept introduced, the patient can neither walk about, nor sit down: but must continually keep himself in bed. Lastly, this mode of operating is frequently counter-indicated, by tumours, or other common diseases, in this part of the body, in consequence of retentions of urine. (*Œuvres Chir. de Desault par Bichat*, Tom. 3, p. 321.)

The puncture of the bladder from the perineum is now almost universally abandoned by British surgeons. "We may esteem it fortunate," says Desault, "if the trocar penetrates directly into the bladder, after piercing the fat and the muscles, situated between the tuberosity of the ischium and the anus; and, as this viscus is subject to much variation in its form, the surgeon will often be defeated, unless he be perfectly clear in his ideas respecting its situation and figure. This disappointment is not without example, and there is sufficient cause to deter a practitioner from performing this operation, independently of the danger of wounding with the trocar the vasa deferentia, vesiculæ seminales, ureter," &c. (*Parisian Chir. Journ.* V. 2, p. 267.)

If there be now any practitioners, who are averse to the total relinquishment of this method, I think the following caution, given by Sabatier, may be of service to them: perhaps, the operation would be more safe, if the surgeon were to begin with making a deep incision in the perineum, as is practised in the lateral way of cutting for the stone, and if he were to desist

from plunging the trocar into the bladder, until he had assured himself of the situation of this viscus, and felt the fluctuation of the urine. This advice was given by Garengeot to Foubert, in regard to the mode of cutting for the stone practised by the latter; and it seems equally applicable in the present place. (*Médecine Opératoire*, Tom. 2. p. 127.)

As in cases of inveterate strictures, the urethra between the obstruction and the bladder is always dilated, I think with Mr. C. Bell, that it may sometimes be better practice to cut into such distended portion of the passage, than puncture the bladder. On this point, many useful remarks may be found in this gentleman's *Surgical Observations*, Part 5, &c. the tenor of which I have more particularly considered in the 2d vol. of the 4th Ed. of the *First Lines of Practice of Surgery*.

2. Puncture above the Pubes.

The invention of the method of tapping the bladder above the pubes was suggested by the possibility of extracting calculi from that viscus, by what is usually denominated the high operation. The first performers of the puncture above the pubes are said to have employed a straight trocar, the very same instrument as was used for tapping the abdomen in cases of dropsy. The consequence was, that when such a trocar was too long, its cannula was apt to hurt the opposite parietes of the bladder, so as to occasion inflammation and a slough, on the separation of which the urine was liable to insinuate itself either into the abdomen, or rectum, as happened in a case mentioned by Mr. Sharp, where no more urine was discharged through the cannula, and the patient died of a sort of diarrhœa. When the trocar is short, the bladder on subsiding and contracting itself, gradually quits the cannula, which becomes useless, and a necessity for making another puncture may be produced. Whatever pains may be taken to direct the trocar obliquely downwards and backwards, so that the cannula may be, in some degree, parallel to the axis of the bladder, one, or the other of these accidents, cannot always be prevented.

Their prevention, however, may be effected by merely employing, instead of a straight trocar, a curved one, which will naturally take a suitable direction. This improvement was embraced by Frère Côme, the inventor of the lithotome caché, who also devised a curved trocar, for the paracentesis of the bladder, very superior to the instrument of the same shape previously in use.

To this way of operating, Mr. Sharp was partial, and Mr. Abernethy has more recently recommended it, under certain circumstances. The former celebrated surgeon remarks, that it is an operation of no difficulty to the surgeon, and of little pain to the patient, the violence done to the bladder being at a distance from the parts

affected. It is equally applicable, whether the disorder be in the urethra, or prostatic gland, and when there are strictures, the use of bougies may be continued, while the cannula remains in the bladder. (*Critical Inquiry*, p. 125, edit. 4.)

Some writers recommend making an incision, about two inches long, through the linea alba, a little way above the pubes, and then introducing a trocar into the bladder. Others deem this preliminary incision quite useless, asserting that the operation may be performed with equal safety, and less pain to the patient, by puncturing at once the skin, the linea alba, and the bladder. When the trocar has been introduced, the stilette must be withdrawn, and the cannula kept in its position by a riband, passed through two little rings, with which it should be constructed, and fastened round the body. The orifice of the cannula should be stopped up with a little plug, so as to keep the urine from dribbling away involuntarily, and taken out as often as may be necessary. (*Encyclopédie Méthodique*; Part. Chirurg. Art. *Paracentese de la Vessie*.)

The trocar should be introduced in a direction obliquely downward and backward; for as this corresponds with the axis of the bladder, the instrument will be less likely to injure the opposite side of that organ.

Nearly all writers advise the puncture to be made an inch, or an inch and a half above the pubes. The reasons for so doing are the following: "If the puncture be made close to the os pubis, the bladder in that part, often rising with an almost perpendicular slope, leaves a chasm between it and the abdominal muscles, or, to speak more strictly, a certain depth of membrana cellularis only, so that, if the trocar penetrate but a little way, it possibly may not enter into the bladder. If it penetrates considerably, it may pass through the bladder into the rectum, or, if not in the operation itself, some days afterwards, when by the course of the illness and confinement the patient is more wasted. For, the abdominal muscle, shrinking and falling in, occasion the extremity of the cannula to press against the lower part of the bladder, and, in a small time, to make a passage into the rectum." (*Sharp in Critical Inquiry*, p. 127.) Though the reasons here adduced seem at first as formidable as they are numerous, does not the danger of injuring the peritoneum form an objection to plunging in a trocar at the above distance from the pubes? Certain it is, peritonitis would be more apt to be induced by such practice, than by introducing the instrument immediately above the pubes. Richerand decidedly condemns the plan, principally because the higher the puncture is made, the more apt will the bladder be to quit the cannula, on the urine being discharged. (See *Nosogr. Chir. T. 3. p. 472, Ed. 2.*) In Desault's works, by Bichat, the puncture is also advised to be made immediately above the pubes. Tom. 3, p. 318. Some of Mr. Sharp's objections are done away, by taking

care to pass the trocar into the bladder in the axis of this viscus, and employing one which is somewhat curved, as Hunter, Frère Côme, Sabatier, &c. have advised. Mr. Sharp confirms the danger of using too long a cannula, by mentioning an accident, which occurred in his own practice. Though he introduced the instrument more than an inch and a half above the os pubis, yet having pushed it full two inches and a half below the surface of the skin, its extremity in six or seven days insinuated itself into the rectum. (*Critical Inquiry*, p. 127.) The instrument, says an excellent writer, should be more or less long, according as the patient is fat, or otherwise; but, the ordinary length should be about four inches and a half. The curvature should be uniform, and form the segment of a circle, about eight inches in diameter. (*Œuvres Chir. de Desault par Bichat*, T. 3, p. 317.)

A catheter left in the bladder, longer than ten days, may possibly gather such an incrustation from the urine, as not only to render the extraction of it painful, but even impracticable. Surgeons, therefore, should never leave the cannula in the bladder quite a fortnight: or, if it must be kept introduced so long, Mr. Sharp advises a second one to be introduced, made with an end, like that of a catheter. (*Critical Inquiry*, p. 129.)

Mursinna, however, has reported one example, in which a cannula was kept in for a longer time without inconvenience. (*Hecker, Annales der Ges. Medicin.* 1810, *Jul.* p. 39.)

Mr. Abernethy makes an incision, between the pyramidal muscles, passes his fingers along the upper part of the symphysis pubis, so as to touch the distended bladder, and introduces a common trocar, of the middle size, in a direction obliquely downwards. On withdrawing the stilette, he passes a middle-sized hollow elastic catheter, through the cannula, into the bladder. The cannula is withdrawn, and the catheter left in, till the urine passes through the urethra. After a week, as the instrument begins to be stopped up with mucus, it is taken out, and a new one introduced. (*Surgical Observations*, 1804.) It might be objected to this plan of employing a hollow bougie, that, as it is smaller than the wound, the urine is not kept from passing between the instrument, and parts, into which it is introduced, as well as through the tube itself. This happened in Mr. Abernethy's case, and, though no urine in this instance got into the cellular membrane, it might probably sometimes do so, because, it is not till after inflammation has taken place that the cavities of the cellular substance are closed with coagulating lymph. After a time, however, the cannula of the trocar might be withdrawn, and the hollow bougie employed, if preferred, though it seems difficult to discover a reason for the preference.

The following is one of Sir E. Home's conclusions: "When the puncture is made above the pubes, the cannula, which incloses the trocar, is not to be removed, till

the surrounding parts have been consolidated by inflammation, so as to prevent the urine in its passage out from insinuating itself into the neighbouring parts; for wherever the urine lodges, mortification takes place. Any advantage, therefore, which may arise from a more flexible instrument remaining in the bladder, is more than counterbalanced by its not filling completely the aperture through the coats of the bladder, and allowing the urine to escape into the cellular membrane." (*Trans. of a Soc. for Med. and Chir. Knowledge*, V. 2.)

There is much truth in the following passage: The abdomen is inflamed; the preliminary incisions, which prepare for the introduction of the trocar, sometimes pass through several inches of fat, and cellular substance; the incisions must be wide in proportion to their depth; the cannula is no sooner lodged here, than it is displaced, in some degree, by the contraction of the bladder, which, when emptied, subsides under the pubes. The cannula stands so obliquely, that the urine never flows with ease, but, by running out upon the wound, and by being injected among the cellular substance, it causes the wound to inflame; the wound by its proximity to the inflamed peritonæum soon mortifies, and thus, notwithstanding the temporary relief, produced by the emptying of the bladder, the patient dies on the third or fourth day. (*John Bell's Principles of Surgery*, Vol. 2, p. 271.)

That this operation is infinitely better, than that of making the puncture in the perineum, is indisputable. There are even now some good surgeons, who seem to prefer it to the method of tapping the bladder from the rectum. In the *Œuvres Chirurgicales de Desault*, Tom. 3. p. 324, it has received the preference, and at p. 319, of the same book, a high encomium is bestowed on it, in the following terms. "This operation is easy. The little thickness of the parts which are to be wounded, renders it quick and triflingly painful. The surgeon has occasion for no assistance. The patient is neither intimidated, nor fatigued with the posture in which he is put. It is almost impossible to miss the bladder, except it were exceedingly contracted. There is no risk of piercing the cavity of the abdomen. Anatomy proves, that here the bladder is in immediate contact with the recti muscles, and that when this viscus is distended with urine, it pushes the peritonæum upwards, and backwards, under which membrane it enlarges, and thus makes the point of the trocar become more and more distant from the cavity of the abdomen. The patient may easily lie on his side, or abdomen, so as to discharge all the urine contained in the bladder. There are here no nerves, nor vessels, of which the injury can be dangerous. No difficulty is experienced in fixing the cannula, and the presence of this instrument does not hinder the patient from sitting, standing up, or even walking about in his chamber. When the cannula, also, is introduced to the lower part of the blad-

der, this viscus cannot possibly quit it. Lastly, the wound heals with more facility, than that made in any other method."

Respecting this advice to push the cannula so far into the bladder, it is highly objectionable, for the reason already explained. The writer of the preceding commendation seems to me rather too partial. He has told us of the little thickness of the wounded parts, and, yet a little before bestowing these praises, he has acknowledged, "*il est rare, que dans cette ponction, on traverse directement la ligne blanche: on passe presque toujours sur ses côtés, et l'on divise la peau, l'aponévrose des muscles larges du bas-ventre, les muscles droits, quelquefois l'un des pyramidaux, et la paroi antérieure de la vessie.*" (Tom. 3, p. 318.)

According to my own judgment, the plan which is about to be described, is the safest and best, when the circumstances of the case afford a choice, and I think, that it would be for the benefit of the afflicted, if the puncture above the pubes were only performed in cases, in which the enormous enlargement of the prostate gland, and the disease in the rectum, prevent a puncture from being safely made from the rectum.

3. Puncture from the Rectum.

This method is more generally applicable, than either of the two plans above related. It is not, like the puncture in the perinæum, liable to the objection, that the wound is made in diseased or inflamed parts, which afterwards become gangrenous. Nor is it, like the puncture above the pubes, attended with a chance of the urine diffusing itself in the cellular membrane. It has also the advantage of emptying the bladder completely. The puncture is made sufficiently far from the neck of the bladder not to increase any inflammation existing in that situation; and the operation is really attended with little pain, since there is no skin, nor muscles to be wounded, merely the coats of the bladder and rectum; at a point where these viscera lie in contact with each other. The enlargement of the prostate gland, and disease of the rectum, are, perhaps, the only solid reason against its being uniformly preferred.

When the bladder is to be tapped from the rectum, two fingers should be introduced into the intestine, instead of one, as has been directed. In this manner, the cannula can be more conveniently guided, and held in a proper position, while the trocar is introduced with the other hand. The stilette, however, must never be introduced into the cannula, except when this is properly placed, with its extremity against the part, where it is intended to make the puncture.

We read in the *Philosophical Transactions* for 1776, of a case of total retention of urine, from strictures, where the bladder was successfully punctured from the rectum. Mr. Hamilton, who did the operation, thought of the plan, in consequence

of feeling the bladder exceedingly prominent in the rectum, on introducing his finger into the anus.

The patient was placed in the same position as that for lithotomy; a trocar was passed along the finger into the anus, and pushed into the lowest and most projecting part of the swelling, in the direction of the axis of the bladder. A straight catheter was immediately introduced through the cannula, lest the bladder by contracting should quit the latter, which was taken away, and, as soon as the water was discharged, the catheter was also removed. Notwithstanding the puncture, the bladder retained the urine as usual, until a desire to make water occurred. Then the opening made by the instrument seemed to expand, and the water flowed in a full stream from the anus. The urine came away in this manner, two days, after which it passed the natural way, with the aid of a bougie, which had been passed through the urethra, into the bladder, and which was used, till all the disease in this canal was cured.

The method is said to have been originally proposed in 1750, by Mr. Fleurant, surgeon of the hospital *La Charité*, at Lyons; and Pouteau, in 1760, published an account of it, and three cases in which Fleurant had operated. It was also the feel of the bladder; on the introduction of a finger *intra anum*, which led the latter surgeon to choose making a puncture in this situation. The urine was immediately discharged, and the cannula supported in its place with the T bandage, until the natural passage was rendered pervious again. But the cannula, being allowed to remain in the rectum, became inconvenient to the patient, when he went to stool, and the inconvenience was vastly increased by the continual dribbling of the urine from the mouth of the instrument. Hamilton avoided both these inconveniences, by withdrawing the cannula at first. In another instance, however, Fleurant left the cannula in the anus and bladder, thirty-nine days, without the least inconvenience.

In order to lessen the inconvenience, attending the presence of the cannula, Fleurant suggested that it would be better to have the tube made of a flexible substance; a proposal, that seems to merit attention, though, I believe, the inconveniences of wearing the cannula are not in general very serious, and were a case of this kind to present itself, I should have no hesitation in withdrawing the tube altogether.

In the first volume of the *Mem. of the Medical Society of London*, two cases are related, in which, after tapping the bladder from the rectum, the cannula was immediately withdrawn, without any bad effect; and a similar fact is recorded in the *Medical Communications*, Vol. 1.

A curved trocar, of sufficient length, is the best for performing the operation, and was recommended by Pouteau. As the trocar with a lancet-point may cut blood vessels, which would bleed freely, some

authors express their preference to one made with a triangular point. (*Howship, p. 315.*) It should be introduced into the prominence made by the distended bladder, a little beyond the prostate gland, exactly in the centre of the front of the rectum; but not imprudently far up the intestine, lest the peritoneum be injured. For some useful cautions on this head, the profession are indebted to Mr. Carpie, who has very properly adverted to the very low point to which the portion of peritoneum reflected over the rectum descends. (*Hist. of the High Operation, &c. p. 178, 8vo. Lond. 1819.*) By keeping the point of the trocar in the centre of the anterior part of the rectum, and not introducing it without first distinctly feeling with the end of the finger, the exact place into which it is to enter, the vesiculæ seminales, which diverge from each other above, will not be wounded; and even were they so, perhaps no serious consequences would follow.

It is not necessary to retain the cannula in the puncture, after the inflammation has consolidated the sides of the wound, and there is no danger of the aperture closing up, till there is another passage made for the urine. Sir E. Home thinks, that, after about thirty-seven hours, the cannula may be properly taken out. (*Trans. of a Soc. for Med. and Chir. Knowledge, Vol. 2.*) Indeed, I am not acquainted with any fact, showing the ill effect of removing the cannula at once; for, here the urine has only to pass through a mere opening, without any longitudinal extent, like what remains after puncturing above the pubes. The safety and simplicity of tapping the bladder from the rectum, will always recommend this method to impartial practitioners. The wound is made at a distance from the peritoneum, passes through no thickness of parts, and is quite unattended with any chance of the urine becoming extravasated in the cellular substance. Whether the bladder be morbidly contracted and thickened; whether the neck of the bladder be inflamed; it is equally applicable; enlargement of the prostate gland, and much disease in the rectum, can alone warrant the puncture above the pubes being ever preferred.

I am happy to join the experienced and judicious Mr. Hey with the advocates for this mode of performing the operation, and as his opinion on this subject must have considerable influence, I shall quote the following passage from his valuable work, particularly as the observations confirm some other points, adverted to in the present article. "It is sometimes impossible, from various causes, to make a catheter pass through the urethra. The puncture of the bladder then becomes necessary, if the retention of urine continues. This operation may be performed, either above the pubes, or through the rectum. I have seen it performed in both these methods; but, give the preference to the latter. It is more easy to the surgeon; and less painful

to the patient. Pouteau's curved trocar is a very convenient instrument; and may be used with safety for puncturing the bladder through the rectum; but, the operator should cautiously avoid wounding an artery, which may be felt running towards the anus, where the bladder is most protuberant. The finger, which is introduced into the rectum to guide the trocar, may be conveniently placed a little on either side of this vessel. It is not always necessary to leave the cannula in the bladder, as the urine sometimes begins to flow through the penis, within a few hours after the bladder is emptied. Perhaps, this event may be the most frequent, when the introduction of the catheter has been prevented by a stricture in the urethra. If the wound becomes closed, before the power of expelling the urine is regained, recourse must be had to a repetition of the operation, which gives very little trouble to the patient: neither is he much incommoded by suffering the cannula to remain two or three days in the bladder. This is sometimes necessary, and seldom improper." (*Hey's Practical Observations in Surgery, p. 430—431, edit. 2.*)

In the foregoing columns, I have briefly adverted to the proposal of cutting into the urethra behind the obstruction, instead of puncturing the bladder. Mr. Grainger, of Birmingham, a few years ago, also recommended cutting into the urethra, immediately in front of the prostate, and relieving the bladder by the introduction of a female catheter through the gland, or, (if that could not be accomplished) by the division of its substance with a scalpel. (*Med. and Surg. Remarks, &c. 8vo. Lond. 1815.*)

Women seldom stand in need of a paracentesis of the bladder; but, when the operation is necessary in them, it is more safely and easily performed from the vagina, than in any other way. If it should be proper to leave the cannula introduced, this must be long enough to allow its orifice to be situated on the outside of the labia, where it must be fixed with a T. bandage.

Consult particularly Sharp on the Operations, Chap. 15. and his Critical Inquiry. Ambr. Bertrandi, Trattato delle Operazioni di Chirurgia, accresciuto di note, &c. dai Chirurghi G. A. Penchienati e G. Brugnone, 8vo. Torino, 1802. Bertrandi was an approver of the puncture from the rectum: so was Le Blanc. *Operat. de Chir. T. 1. Melanges de Chirurgie, par Pouteau, Lyon, 1760, p. 500. L'Encyclopédie Méthodique, Partie Chirurgicale; art. Paracentèse de la Vessie. Schmuicker, Chir. Wahrnehmungen, 2 Th. No. 39: puncture from the rectum. Sabatier's Médecine Opératoire, Tom. 2. Mursinna, Journ. für die Chirurgie, &c. 4, p. 46, 67. Cases of puncture from the rectum, and above the pubes. In illustration of the operation of puncturing the bladder, Camper's plates are the best: See his Demonst. Anat. Pathol. Lib. 2. In this work, the danger of letting the end of any long instrument, when introduced, press against the inside of the bladder, is pro-*

red by a case, in which that organ was perforated by the extremity of a catheter, p. 11. Kloss, *Diss. de Paracentesi Vesicæ Urinariæ per intestinum rectum*, Jen. 1791. A. Bonn, *Anat. Chir. Bemerkungen über die Harnverhaltung, und den Blasenstich*. Leipz. 1794, prefers the puncture above the pubes. J. Houship, *Pract. Obs. on Diseases of the Urinary Organs*, p. 214, Svo. Lond. 1816, thinks the operation from the rectum superior to the other methods. Sir E. Home in *Trans. for the Improvement of Med. and Chir. Knowledge*, Vol. 2. Abernethy's *Surgical Observations*, 1804. John Bell's *Principles of Surgery*, Vol. 2. *Ouvres Chir. de Desault par Bichat*, T. 3, p. 315, &c. W. Schmid über die Krankheiten der Harnblase, &c. Svo. Wien, 1806. Richerand's *Nosogr. Chir. T. 3*, edit. 4. Hey's *Practical Observations in Surgery*, p. 430, edit. 2. *Parisian Chirurg. Journal*, Vol. 2. p. 156, and p. 265. S. T. Sommering über die schnell und langsam tödlichen Krankheiten der Harnblase, &c. Frankfurt, 1809. The author is an advocate for the puncture above the pubes, in preference to that through the rectum, which he thinks right only in one case, viz. when the bladder is so contracted, that it does not rise out of the lesser cavity of the pelvis, and the fluctuation of the urine can be felt in the rectum, but not above the pubes. In this opinion, he is joined by Langenbeck. (*Bibliothek*, 3 B. p. 719.) Callisen's *Systema Chirurgiæ Hodiernæ*, T. 1, p. 277, &c. *Chirurgische Versuche von B. G. Schreger*, B. 1. Über den Blasenstich Oberhalb der Schoofsuge, p. 211, &c. Svo. Nurnberg. 1811, gives the preference to the puncture above the pubes. Edward Grainger, *Med. and Surg. Remarks*, &c. with *Obs. on the different modes of opening the bladder in retention of urine*, &c. Svo. Lond. 1815. C. Bell, *Surgical Obs.* Svo. Part 5. Lond. 1818.

BLADDER, Tumour extirpated from. Mr. Warner has recorded a case, in which an excrescence, growing from the inside of a young woman's bladder, was successfully removed. The patient, on the 24th of June, 1747, strained herself in endeavouring to lift a great weight, and she was immediately seized with a pain in the small of her back, and a total retention of urine. In April, 1750, she applied to Mr. Warner, who found, upon inquiry, that she had never been able, from the moment of the accident, to void a drop of urine without the assistance of the catheter; that she was in continual pain, and had lately been much weakened, by having several times lost considerable quantities of blood, occasioned by the force made use of in introducing the instrument into the bladder.

Mr. Warner, upon examining the parts with his forefinger, which he had great difficulty in introducing into the meatus urinarius, discovered a considerable tumour, which seemed to be of a fleshy substance, and took its rise from the lower part of the bladder, near its neck. When the patient strained to make water, and the bladder was full, the excrescence protruded a little

way out of the meatus urinarius; but, upon ceasing to strain, it presently returned.

A purgative having been given the day before the operation, and the rectum emptied by means of an emollient clyster, Mr. Warner directed the patient to strain, so as to make the bladder project. He then hindered it from returning into the bladder, by passing a ligature through it, and endeavoured to draw it further out. The latter object was found impracticable, on account of the size of the tumour. Seeing this, Mr. Warner dilated the meatus urinarius on the right side, by cutting it upwards, about half way towards the neck of the bladder, when, by pulling the swelling forwards, he was enabled to tie its base, which was very large, with a ligature.

For three days after the operation, a good deal of pain was felt in the abdomen. On the sixth day, the tumour dropped off. From the first day, the urine came away without assistance, and the patient got quite well. The tumour resembled a turkey's egg in shape and size. (See Warner's *Cases in Surgery*, edit. 5, p. 303.)

Perhaps, in this example, tying the tumour was preferable to cutting it away, even though its base was large; for, had the knife been used, there would have been some danger of the bladder becoming filled with blood.

BLADDER, Hernia of. See *Hernia*.

BLADDER, Insects discharged from. The instances, in which worms are stated to have been discharged from the bladder, are very numerous. Many cases of this kind are referred to in Voigtel's *Handbuch der pathologischen Anatomie*, b. 3, p. 337—342. A few years ago, an interesting example was recorded by Mr. Lawrence. (See *Med. Chir. Trans. V. 2*, p. 382, &c.)

BLADDER, Deficiency of. Numerous examples, in which this deviation from the natural structure has occurred, are recorded by medical writers. The publications, however, which, as far as I know, contain the most ample information on the subject, are, a Göttingen inaugural Dissertation, entitled, "*De Vesicæ Urinariæ Prolapsu Nativo*," by Dr. Roose, late professor in Brunswick, and a paper, called "*An attempt towards a systematic account of the appearances, connected with that malconformation of the Urinary Organs, in which the ureters, instead of terminating in a perfect bladder, open externally on the surface of the Abdomen*," by A. Duncan, jun. in *Edin. Med. and Surg. Journal*, Vol. 1. In this last production, may be seen references to all the most noted cases on record, both male and female. (See also *Handbuch der Pathologischen Anatomie von J. F. Meckel*, 1 B. p. 650, Svo. Leip. 1812.)

BLADDER, Wounds of. See *Gunshot Wounds*. Many cases of rupture of the bladder from blows or falls are recorded, followed by fatal extravasation of urine in the abdomen. Two such instances have been recently detailed by Dr. Cusack. (See *Dub. Hospital Reports*, Vol. 2, p. 312, &c. Svo. 1818.)

* **BLEEDING.** By this operation is understood the taking away of blood for the relief of diseases. Bleeding is called *general*, when practised with a view of lessening the whole mass of circulating blood; *topical*, when performed in the vicinity of the disease, for the express purpose of lessening the quantity of blood in a particular part.

General Blood-letting is performed with a lancet, and is subdivided into two kinds; viz. the opening of a vein, termed *phlebotomy*, or *venesection*; and the opening of the temporal artery, or one of its branches, termed *arteriotomy*.

Topical Blood-letting is performed, either by means of a cupping-glass and scarificator, or leeches, or by dividing the visibly distended vessels with a lancet, as is frequently done in cases of ophthalmia.

PHLEBOTOMY, OR VENESECTION.

The mode of bleeding, most frequently practised, is that of opening a vein; and it may be done in the arm, ankle, jugular vein, frontal vein, veins under the tongue, on the back of the hand, &c. In whatever part, however, venesection is performed, it is always necessary to compress the vein, between the place where the puncture is made, and the heart. Thus the return of blood through the vein is stopped, the vessel swells, becomes conspicuous, and, when opened, bleeds much more freely than would otherwise happen. Hence, according to the situation of the part of the body where the vein is to be opened, with regard to the heart, the bandage, or other means, for making the necessary pressure, must be applied, either above or below the puncture.

All the apparatus essential for blood-letting, on the part of the patient, is a bandage, or fillet, two or more small pieces of folded linen for compresses, a basin to receive the blood, and a little clean water and a towel. The bandage ought to be about a yard in length, and near two inches broad, a common riband or garter being frequently employed. The compresses are made by doubling a bit of linen rag, about two inches square. On the part of the surgeon, it is necessary to have a good lancet, of proper shape. He should never bleed with lancets, with which he has been in the habit of opening any kind of abscesses, as very troublesome complaints have been the consequence of doing so. The shape of the instrument is also a matter of some importance. If its shoulders are too broad, it will not readily enter the vein, and when it does enter, it invariably makes a large opening, which is not always desirable. If the lancet be too spear-pointed, an incautious operator would often run a risk of transfixing the vein, and wounding the artery beneath it. More, however, certainly depends on the mode of introducing the lancet, than on its shape.

In blood-letting, the patient may lie down, sit down, or stand up, each of which posi-

tions may be chosen according to circumstances. If the patient be apt to faint from the loss of a small quantity of blood, and such fainting can answer no surgical purpose, it is best to bleed him in a recumbent posture. But, when the person is strong and vigorous, there is little occasion for this precaution, and a sitting posture is to be preferred, as the most convenient, both for surgeon and patient. This indeed, is the common position. In some cases, however, particularly those of strangulated hernia, it is frequently an object to produce fainting, in order that the bowels may be more easily reduced. In this circumstance the patient may be bled in an erect posture, and the wound made large, as a sudden evacuation of blood is particularly apt to bring on the wished-for swoon. For the same reason, if we wish to avoid making the patient faint, we should then make only a small puncture.

Every operator should be able to use the lancet with either hand, which will enable him to bleed the patient in the right or left arm, as circumstances may render most eligible.

At the bend of the arm, there are several veins in which a puncture may be made; viz. the basilic, cephalic, median basilic, and median cephalic. The median basilic vein, being usually the largest and most conspicuous, is that in which the operation is mostly performed; but surgeons should never forget, that it is under this vessel that the brachial artery runs, with the mere intervention of the aponeurosis sent off from the tendon of the biceps muscle. In very thin persons, indeed, the median basilic vein lies almost close to the artery, and nothing is then more easy than to transfix the first of these vessels and wound the last. Hence Richerand advises all beginners to prefer opening the median cephalic, or even the trunk of the cephalic itself, to puncturing even the basilic, or the median basilic, which last are internally situated, and nearer the brachial artery. (*Nosographie Chirurgicale*, t. 3. p. 383. *edit.* 2.)

In fat subjects, the large veins at the bend of the arm are sometimes totally imperceptible, notwithstanding the fillet is tightly applied, the limb is put in warm water, and every thing done to make those vessels as turgid as possible. In this circumstance, if the surgeon has not had much experience in the practice of venesection, he will do well to be content with opening one of the veins of the back of the hand, after putting the member for some time in warm water, and applying a ligature round the wrist. In children, a sufficient quantity of blood cannot always be obtained by venesection, and, in this event, the free application of leeches, and, occasionally, the puncture of the temporal artery, are the only effectual methods.

With respect to the choice of a vein in the arm, the most experienced operators give the preference to one which rolls least under the skin. Such a vessel, though

sometimes less superficial than another, may commonly be opened with greater facility. The surgeon, however, is always to fix the vein as much as he can, by placing the thumb of his left hand a little below the place where he intends to introduce the lancet.

In bleeding in the arm, the fillet is to be tied round the limb, a little above the elbow, with sufficient tightness to intercept the passage of the blood through all the superficial veins; but never so as to stop the flow of blood through the arteries, which would tend to prevent the veins from rising at all. The veins being thus rendered turgid, the surgeon must choose the one which seems most conveniently situated for being opened, and large enough to furnish as much blood as it may be proper to take away.

Before applying the fillet round the arm, however, the operator should always feel where the pulsation of the artery is situated, and, if equally convenient, he should not open the vein immediately over this part. It is also prudent to examine where a pulsation is situated, on account of the occasional varieties in the distribution of the arteries of the arm. The ulnar artery is sometimes given off from the brachial very high up, and, in this case, it frequently proceeds superficially over the muscles, arising from the internal condyle, instead of diving under them, in the ordinary manner.

When the external jugular vein is to be opened, the surgeon generally makes the necessary pressure with his thumb. The orifice should be made in the direction of the fibres of the platysma myoides muscle; and the vein is not so apt to glide out of the way, when the surgeon makes the puncture just where it lies over a part of the sterno-cleido-mastoideus muscle.

When blood is to be taken from the foot, the ligature is commonly applied a little above the ankle.

The fillet having been put on the arm, the operator is to take the blade of the lancet, bent to a somewhat acute angle, between the thumb and fore-finger, and, steadying his hand upon the other three fingers, he is to introduce the lancet, in an oblique direction, into the vessel, till the blood rises up at the point of the instrument. Then bringing up the front edge in as straight a line as possible, the wound in the skin will be made of just the same size as that in the vein. The operator next takes away the thumb of his left hand, with which he steadied the vessel, and allows the blood to escape freely, till the desired quantity is obtained. The arm ought to be kept in the same position while the blood is escaping, lest the skin should slip over the orifice of the vein, keep the blood from getting out, and make it insinuate itself into the cellular substance.

When the blood does not issue freely, however, most surgeons direct the patient to move his fingers, or turn something round and round in his hand. This puts the mus-

cles of the arm into action, and the pressure they then make on the veins, makes the blood circulate more briskly through these vessels.

The proper quantity of blood being discharged, the fillet is to be untied. The flow of blood now generally ceases; though sometimes, when the orifice is large, and the circulation very vigorous, it still continues. In this circumstance, the operator may immediately stop the bleeding, by placing the thumb of his left hand firmly on the vessel, a little below the puncture.

The blood is next to be all washed off the arm, the sides of the wound placed in contact, and the compresses applied, and secured with the fillet, put round the elbow in the form of a figure of 8, and regularly crossing just over the compresses.

The patient should be advised not to move his arm much till the fillet is removed, which may be done after twenty-four hours.

In order to open the external jugular vein, the patient's head is to be laid on one side, and properly supported. Then the operator is to press upon the lower part of the vein with his thumb, so as to make the part above swell, and then the lancet is to be pushed at once into the vessel, with the cautions already stated.

There is commonly no difficulty in stopping the bleeding, after the pressure is removed. Some practitioners have directed a scalpel to be used for dividing the integuments, before opening the vein itself; but this is quite unnecessary.

Blood-letting in the feet is executed on the same principle as in other parts; but the blood from the veins in this situation, in general, not flowing with much celerity, it is customary to immerse the feet in warm water, in order to promote the bleeding.

ARTERIOTOMY.

The only arteries of any size, from which blood is ever taken in practice, are the trunk and branches of the temporal artery, which lie in such a situation, that they may easily be compressed against the subjacent bones, and the bleeding stopped. When the vessel, which the surgeon chooses to open, lies very near the surface, or can be ascertained by feeling, or even seeing, its pulsation, it may be opened at once with a lancet. But, in many instances, it is so deeply situated, that it becomes necessary, in the first place, to make a cut in the skin, and then puncture the vessel.

The bleeding generally stops without any trouble; and may always be suppressed with a compress and bandage. In a very few cases, the blood bursts forth from time to time, and more is lost than is necessary. When this happens, notwithstanding pressure, it is recommended to divide the vessel completely across, which facilitates the process of nature in closing the end of the vessel. Sometimes an aneurism follows, which must be treated on the principles

explained in a foregoing article. See *Aneurism*. Cavalline cured the disease by dividing the vessel, and compression. (*Collez. di Casi Chir. t. 2.*)

TOPICAL BLEEDING.—CUPPING.

This is done by means of a scarificator, and a glass, shaped somewhat like a bell. The scarificator is an instrument containing a number of lancets, sometimes as many as twenty, which are so contrived, that when the instrument is applied to any part of the surface of the body, and a spring is pressed, they suddenly start out, and make the necessary punctures. The instrument is so constructed, that the depth, to which the lancets penetrate, may be made greater or less, at the option of the practitioner. As only small vessels can be thus opened, a very inconsiderable quantity of blood would be discharged, were not some method taken to promote the evacuation. This is commonly done with a cupping-glass, the air within the cavity of which is rarified, by the flame of a little lamp, containing spirit of wine, and furnished with a thick wick. This plan is preferable to that of setting on fire a piece of tow, dipped in this fluid, and put in the cavity of the glass; a clumsy expedient, adding unnecessarily to the sufferings of the patient, by cauterizing the skin; doing harm also by rarifying the air more than necessary within the glass, in consequence of which the edges of the cup compress the cutaneous vessels so much as to obstruct the influx of blood. The larger the glass, if properly exhausted, the less pain does the patient suffer, and the more freely does the blood flow." (See *Mapleson's Treatise on the Art of Cupping*, p. 63—65. 12mo. Lond. 1813.) When the mouth of the glass is placed over the scarifications, and the rarified air in it becomes condensed as it cools, the glass is forced down on the skin, and a considerable suction takes place.

This professor of the said art says, that when the operation is about to be done, a basin of warm water, a piece of fine sponge, and a lighted candle, should be provided. As many of the cupping-glasses as may be judged necessary are to be put in the basin. If sixteen or twenty ounces of blood are to be taken away, four glasses, of a size adapted to the surface to which they are to be applied, will generally be required. Each glass is then to be held for an instant over the flame of the spirit-lamp, and immediately placed upon the skin. Upon the quickness with which this is done, the neatness and efficacy of the operation will depend. If dry cupping be only intended, the glasses may be allowed to remain on the skin for a few moments, and be replaced five or six times, with a little variation of their position, in order to prevent the skin from being hurt by their pressure. If the intention be to scarify and take away blood, the glass ought not to remain more than a minute, when the scarificator

is to be instantly applied; for by the quickness with which the application of the scarificator succeeds the removal of the glass, the patient is saved a degree of pain, which he would otherwise suffer from the making of the punctures. When the glasses are so full as to be in danger of falling off, or the blood is coagulated in them, they should be removed, emptied, and applied again. For the sake of neatness, care should be taken to insert the nail under the upper part of the glass, and remove it so as to keep its bottom downwards, the scarifications being at the same time wiped with a sponge, wet in warm water. The glasses also previously to each application, should be rinsed in warm water, but not dried. For these, and some other useful directions, see *Mapleson's Treatise*, p. 64, &c.

Trials have been made of syringes, calculated for exhausting the air from cupping-glasses; but the plan is not found so convenient as that above described.

A common pledget, or bit of rag, is usually applied as a dressing for the punctures made with a scarificator.

If a little smarting be not minded, Mr. Mapleson prefers the application of arquebuseade water, or spirits of wine, as it immediately stops the oozing of blood, and prevents subsequent itching. (P. 69.)

LEECHES.

Leeches are often preferable to cupping, which is attended with more irritation than many surfaces, under particular circumstances, can bear, especially when the topical bleeding is to be frequently repeated; and they can be used in cases in which it would not be safe or convenient to employ the lancet.

Formerly medicinal leeches were very abundant in England, but owing to their now being in greater request, and to the draining and cultivation of waste lands, it is necessary to import large supplies from the continent, chiefly from Bourdeaux and Lisbon. As much imposition prevails in this branch of commerce, it should be understood, that unless a leech be marked with yellow rings, or spots, or with variegated lines, running the whole length of the back, it will generally be found useless. (See *A Treatise on the Medicinal Leech*, by J. R. Johnson, p. 133, 8vo. Lond. 1816.)

When leeches are to be kept in any considerable quantity, this gentleman recommends them to be placed in a large vessel, provided with a false bottom, so perforated as to allow them a ready passage. This false bottom should be raised from three to six inches above the real bottom, or to such an extent as will admit of a turf, of nearly equal dimensions, being placed between them. It should fit closely to the sides, that the earth may not be disturbed by the frequent introduction of fresh water. It is necessary that the vessel be also furnished with a stop-cock, in order that the water may be drawn off as often as may be con-

sidered expedient. But previously to our placing the leeches in this vessel, they should be singly examined. If on being handled, they contract, and feel hard and firm, it affords the best indication of their being healthy; but should they feel flabby, or exhibit protuberances, or white ulcerous specks on the surface, they should be kept in jars by themselves, the water and the turf of which should be frequently renewed." (*Op. cit.* p. 133.)

Leeches, occasionally, cannot be easily made to fix on the particular part we wish; but they will do so, if the place be first cooled with a cloth dipped in cold water, or if it be moistened with cream or milk, and they be confined in the situation with a small glass.

According to Dr. Johnson, the part on which it is intended they shall fix should be as clean as possible; it should, therefore, be first washed with soap and water, and afterwards with water alone, which will be more necessary should any liniment or embrocation have been used. Leeches are often found to bite better, when removed from the water at least an hour previously to their application. In the common practice of putting as many of them as may be required into a wine-glass, and inverting it upon the part affected, there is the disadvantage, that they frequently retire to the upper part of the glass, and cannot be got down again, without some risk of displacing those which have already fastened. To remedy this inconvenience, Dr. Johnson recommends glass vessels of various sizes and figures, but none of them more than an inch deep. But, in his own practice, he prefers applying leeches with his hand. "Bring a leech towards the part whereon you intend to fix it, and as soon as it begins to extend the head, to seek an attachment, endeavour that it may affix itself to the place required." When it evinces no disposition to bite, a little puncture may be made with a lancet, when the animal will fix itself. "When the patient is fearful of the lancet, and one leech only shall have bitten, where several are required, it may be of use to remove it, which is readily done by inserting the nail of the finger between its mouth and the skin. The blood then flowing from the orifice, will induce the remainder to bite with the greatest avidity. As soon as the leeches are gorged, they drop off; this usually happens within ten or fifteen minutes. Sometimes they remain affixed a considerable time, and become indolent; but they are quickly roused from this state by sprinkling them with a few drops of cold water." (*Johnson, op. cit.* p. 141.) When they fall off, the bleeding may be promoted, if necessary, by fomenting the part. When the bleeding continues longer than is desirable, a slight compress will usually stop it; but in more troublesome cases, the compress must be dipped in brandy, or spirits of wine. In young infants, the hemorrhage from the bites of leeches has sometimes proved fatal, and

the same thing may happen in adults. An example of each fact is related by Beauchene (*Gazette de Santé*, Sept. 1815.) When the bleeding is very troublesome, Autenrieth advises pieces of charpie to be pushed into the orifices of the bites; a method which he assures us, is perfectly effectual. (*Tubingen Blatter*, B. 2. St. 1. p. 57.)

In order to make a leech disgorge, it is usual to throw a little salt upon it: in a few seconds the blood is rejected, the leech assumes a coiled form, and is seldom found fit for use again before the end of four or five days. As salt, however, frequently blisters the leech, it has been proposed to empty the animal by regular and uniform pressure; but though Dr. Johnson considers this plan better than the other, he admits that it is scarcely practicable, without injuring the internal structure of the leech. He says, the best method, and that from which the animal suffers the least inconvenience, is pouring a small quantity of vinegar upon its head. Leeches which have been recently applied should always be kept by themselves, and allowed to retain, for their nourishment, about one-third of the blood which they extract. For a great deal of valuable information respecting leeches, see Johnson's work, the title of which is above specified.

When leeches are very scarce, their tails may be snipped off, while they are sucking, and the blood will then flow, drop by drop, from the artificial opening, as fast as the animals suck it; or with the same view, an incision may be made with a lancet, close to the tail. (*Johnson, Op. cit.* p. 144.)

SCARIFICATION WITH A LANCET.

Is mostly done in cases of inflamed eyes. An assistant is to raise the upper eyelid, while the surgeon himself depresses the lower one, and makes a number of slight scarifications, where the vessels seem most turgid, trying particularly to cut the largest completely across.

ILL CONSEQUENCES SOMETIMES FOLLOWING BLEEDING IN THE ARM.

1. Ecchymosis.

The most common is a thrombus, or ecchymosis, a small tumour around the orifice, and occasioned by the blood insinuating itself into the adjoining cellular substance, at the time when this fluid is flowing out of the vessel. Changing the posture of the arm will frequently hinder the thrombus from increasing in size, so as to obstruct the evacuation of blood. But, in some instances, the tumour suddenly becomes so large, that it entirely interrupts the operation, and prevents it from being finished. In these cases, however, the most effectual method of preventing the tumour from becoming still larger, is to remove the bandage. By allowing the bandage to remain, a very considerable swelling may

be induced, and such as might be attended with great trouble. If more blood be required to be taken away, it ought to be drawn from another vein, and what is still better, from a vein in the other arm.

The best applications for promoting the absorption of these tumours, are those containing spirit, vinegar, or the muriate of ammonia. Compresses, wetted with any lotion of this sort, may be advantageously put on the swelling, and confined there with a slack bandage.

2. Inflammation of the Integuments and adjacent Cellular Substance.

According to Mr. Abernethy, the inflammation and suppuration of the cellular substance, in which the vein lies, are the most frequent occurrences. On the subsidence of this inflammation the tube of the vein is free from induration. Sometimes the inflammation is rather indolent, producing a circumscribed and slowly suppurating tumour. Sometimes it is more diffused, and partakes of the erysipelatous nature. On other occasions, the affection is of the phlegmonous kind.

When the lancet has been bad, so as rather to have lacerated than cut the parts; when the constitution is irritable, and especially when care is not taken to unite the edges of the puncture, and the arm is allowed to move about, so as to make the two sides of the wound rub against each other, inflammation will most probably ensue. The treatment of this case consists in keeping the arm perfectly at rest in a sling, applying the saturine lotion, and giving one or two mild saline purges. When suppuration takes place, a small poultice is the best local application.

3. Absorbents inflamed.

Sometimes, particularly when the arm is not kept properly quiet after bleeding, swellings make their appearance about the middle of the arm, over the large vessels, and on the fore-arm, about the mid-space, between the elbow and wrist, in the integuments covering the flexor muscles. The swelling at the inner edge of the biceps is sometimes as large as an egg. Before such swellings take place, the wound in the vein often inflames, becomes painful, and suppurates, but without any perceptible induration of the venal tube, either at this time, or after the subsidence of the inflammation. Pain is felt shooting from the orifice in the vein, in lines up and down the arm, and upon pressing in the course of this pain, its degree is increased. On examining the arm attentively, indurated absorbents may be plainly felt, leading to the tumour at the side of the biceps muscle.

The pain and swelling often extend to the axilla, where the glands also sometimes enlarge. Chordlike substances, evidently absorbents, may sometimes be felt, not only leading from the puncture to the swelling in the middle of the arm, but also from this

latter situation up to the axillary glands, and from the wound in the vein down to the enlarged glands at the mid-space between the elbow and wrist, over the flexor muscles of the hand.

The enlarged glands very often proceed to suppuration, and the patient suffers febrile symptoms. It may be suspected that the foregoing consequences arise from the lancet being envenomed, and from the absorption of the virulent matter; but the frequent descent of the disease to the inferior absorbents militates against this supposition.

When the absorbents become inflamed, they quickly communicate the affection to the surrounding cellular substance. These vessels, when indurated, appear like small chords, perhaps of one eighth of an inch in diameter: this substance cannot be the slender sides of the vessels, suddenly increased in bulk, but an induration of the surrounding cellular substance.

The inflammation of the absorbents, in consequence of local injury, is deducible from two causes; one, the absorption of irritating matter; and the other, the effect of the mere irritation of the divided tube. When virulent matter is taken up by the absorbents, it is generally conveyed to the next absorbent gland, where its progress being retarded, its stimulating qualities give rise to inflammation, and, frequently, no evident disease of the vessel, through which it has passed, can be distinguished.

When inflammation of the absorbents happens in consequence of irritation, the part of the vessel nearest the irritating cause, generally suffers most, while the glands, being remotely situated, are not so much inflamed.

The treatment of the preceding case consists in keeping the arm perfectly quiet in a sling, dressing the puncture of the vein with any mild simple salve, covering the situation of the inflamed lymphatics with linen wet with the saturnine lotion, and giving some gentle purging medicine.

When the glandular swellings suppurate, poultices should be applied, and if the matter does not soon spontaneously make its way outward, the surgeon may open the abscess. (See *Abernethy's Essay on this subject.*)

4. Inflammation of the Vein.

When the wound does not unite, the vein itself is very likely to inflame. This affection will vary in its degree, extent, and progress. One degree of inflammation may only cause a slight thickening of the venal tube, and an adhesion of its sides. Abscesses, more or less extensive, may result from an inflammation of greater violence, and the matter may sometimes become blended with the circulating fluids, and produce dangerous consequences, or the matter may be quite circumscribed, and make its way to the surface. When the vein is extensively inflamed, a good deal of sympathetic fever is likely to ensue, not

merely from the excitement, which inflammation usually produces, but also from the irritation continued along the membranous lining of the vein towards the heart. If, however, the excited inflammation should fortunately produce an adhesion of the sides of the vein to each other, at some little distance from the wounded part, this adhesion will form a boundary to the inflammation, and prevent its spreading further. The effect of the adhesive inflammation in preventing the extension of inflammation along membranous surfaces, was originally explained by Mr. Hunter. In one case, Mr. Hunter applied a compress to the inflamed vein, above the wounded part, and he thought that he thus succeeded in producing an adhesion, as the inflammation was prevented from spreading further. When the inflammation does not continue equally in both directions, but descends along the course of the vein, its extension in the other direction is probably prevented by the adhesion of the sides of the vein to each other. (See *Obs. on the Inflammation of the internal coats of veins*, by J. Hunter, in *Trans. of a Soc. for the Improvement of Med. & Chir. Knowledge*, Vol. 1, p. 18, &c.) More information on this subject will be found under the head of *Veins*.

Mr. Abernethy mentions his having seen only three cases, in which an inflammation of the vein succeeded venesection. In neither of these did the vein suppurate. In one, about three inches of the venal tube inflamed, both above and below the puncture. The integuments over the vessel were very much swollen, red, and painful, and there was a good deal of fever, with a rapid pulse, and furred tongue. The vein did not swell, when compressed above the diseased part. In another instance, the inflammation of the vein did not extend towards the heart, but only downward, in which direction it extended as far as the wrist.

The treatment is to lessen the inflammation of the vein by the same means, which ether inflammations require, and to keep the affection from spreading along the membranous lining of the vessel towards the heart, by placing a compress over the vein, a little way above the puncture, so as to make the opposite sides of the vessel adhere together.

Mr. Abernethy can conceive a case, in which the vein may even suppurate, and a total division of the vessel be proper, not merely to obviate the extension of the local disease, but to prevent the pus from becoming mixed with the circulation. Were such a proceeding deemed right, I think Mr. Brodie's method of cutting the vessel would be best. However, I have never heard of any case, in which the practice has been adopted. As for the scheme of tying the vein above the diseased part of it, the severe effects frequently following this method, must, as Mr. Dunn has reminded me, render it less eligible, than incision.

3. Inflammation of the Fascia of the Fore-Arm.

Sometimes, in consequence of the inflammation arising from the wound of the lancet in bleeding, the arm becomes very painful, and can hardly be moved. The puncture often remains unhealed, but without much inflammation of the surrounding integuments. The fore-arm and fingers cannot be extended without great pain. The integuments are sometimes affected with a kind of erysipelas; being not very painful, when slightly touched, but when forcibly compressed, so as to affect the inferior parts, the patient suffers a good deal. The pain frequently extends towards the axilla and acromion; no swelling, however, being perceptible in either direction. These symptoms are attended with considerable fever. After about a week, a small superficial collection of matter sometimes takes place a little below the internal condyle: this being opened, a very little pus is discharged, and there is scarcely any diminution of the swelling or pain. Perhaps, after a few days more, a fluctuation of matter is distinguished below the external condyle, and this abscess being opened, a great deal of matter gushes from the wound, the swelling greatly subsides, and the patient's future sufferings are comparatively trivial.

The last opening, however, is often inadequate to the complete discharge of the matter, which is sometimes originally formed beneath the fascia, in the course of the ulna, and its pointing at the upper part of the arm depends on the thinness of the fascia in this situation. The collection of pus descends under the lower part of the detached fascia, and a depending opening for its discharge becomes necessary. This being made, the patient soon gets well.

In these cases, neither the vein nor the absorbents appear inflamed. The integuments are not much affected, and the patient complains of a tightness of the fore-arm. Matter does not always form, and the pliability of the arm, after a good while, gradually returns again.

Mr. Watson relates a case, which was followed by a permanent contraction of the fore-arm. Mr. Abernethy is of opinion, that a similar contraction of the fore-arm, from a tense state of the fascia, may be relieved by detaching the fascia from the tendon of the biceps, to which it is naturally connected. Mr. Watson seems to have obtained success in his first case, by having cut this connexion.

The treatment of an inflamed fascia, in consequence of venesection, has in it no peculiarity. General means for the cure of inflammation should be employed. The limb should be kept quiet, and the inflamed part relaxed. As soon as the inflammation abates, the extension of the fore-arm and fingers ought to be attempted, and daily performed, to obviate the contraction, which might otherwise ensue. (*Abernethy*.)

Mr. Charles Bell objects to calling the

affection an inflammation of the fascia, because he sees no proof of this part being inflamed, and he conceives that the symptoms proceed from the inflammation spreading in the cellular membrane, and passing down among the muscles, and under the fascia. The fascia acts as a bandage, and from the swelling of the parts beneath, it binds the arm, but is not itself inflamed, and contracted. When necessary to divide the fascia, Mr. Charles Bell thinks it would be better to begin an incision near the inner condyle of the humerus, and to continue it some inches down the arm, rather than perform the nice, if not dangerous operation, of cutting the fascia, at the point where the expansion goes off from the round tendon of the biceps.

When the elbow joint and fore-arm continue stiff after all inflammation is over, Mr. C. Bell recommends frictions with camphorated mercurial ointment, &c. and the arm to be gradually brought into an extended state by placing a splint on the forepart of the limb. (*Operative Surgery*, Vol. 1. p. 65.)

6. Ill Consequences of a Wounded Nerve.

Mr. Abernethy informs us, that Mr. Pott used to mention two cases, in which the patients had suffered distracting pains, followed by convulsions and other symptoms, which could only be ascribed to nervous irritation, arising from a partial division of the nerve, and he recommended its total division, as a probable remedy. Dr. Monro related similar cases, in which such treatment proved successful.

Hence, it is highly necessary to know the characteristic symptoms of the case, particularly, as all the foregoing cases would be exasperated by the treatment just now alluded to. It is to Mr. Abernethy that we are indebted for several valuable remarks elucidating this subject. He informs us, that the two cutaneous nerves are those which are exposed to injury. Most frequently all their branches pass beneath the veins, at the bend of the arm; but sometimes, although the chief rami go beneath these vessels, many small filaments are detached over them, which it is impossible to avoid wounding in phlebotomy.

Mr. Abernethy thinks the situation of the median nerve, renders any injury of it very unlikely. If, however, a doubt should be entertained on this subject, an attention to symptoms will soon dispel it. When a nerve is irritated at any part, between its origin and termination, a sensation is felt, as if some injury were done to the parts which it supplies. If, therefore, the cutaneous nerves were injured, the integuments of the fore-arm would seem to suffer pain; if the median nerve, the thumb, and two next fingers would be painfully affected. — (*Abernethy*).

What are the ills likely to arise from a wounded nerve? If it were partially cut, would it not, like a tendon, or any other substance, unite? It seems probable that it would do so, as nerves, as large as the cu-

taneous ones of the arm, are very numerous in various situations of the body, and are partially wounded in operations, without any peculiar consequences usually ensuing. The extraordinary pain sometimes experienced in bleeding, may denote that a cutaneous nerve is injured. The situation of the nervous branches is such, that they must often be partially wounded in the operation, though they probably unite again; in almost all cases, without any ill consequences. Yet, says Mr. Abernethy, it is possible that an inflammation of the nerve may accidentally ensue, which would be aggravated, if the nerve were kept tense, in consequence of its partial division. Mr. Abernethy thinks the disorder arises from inflammation of the nerve in common with the other wounded parts. This gentleman supposes, that an inflamed nerve would be very likely to communicate dreadful irritation to the sensorium, and that a cure would be likely to arise from intercepting its communication with that organ.

The general opinion is, that the nerve is only partially divided, and that a complete division would bring relief. Mr. Pott proposed enlarging the original orifice. It is possible, however, that the injured nerve may be under the vein, and, if the nerve be inflamed, even a total division of it, at the affected part, would, perhaps, fail in relieving the general nervous irritation, which the disease has occasioned. To intercept the communication of the inflamed nerve with the sensorium, however, promises perfect relief. This object can only be accomplished by making a transverse incision above the orifice of the vein. The incision need not be large, for the injured nerve must lie within the limits of the original orifice, and it need only descend as low as the fascia of the fore-arm, above which all the filaments of the cutaneous nerves are situated. As the extent of the inflammation of the nerve is uncertain, Mr. Abernethy suggests even making a division of the cutaneous nerve still further from the wound made in bleeding.

Examples are recorded, in which not only extraordinary pain was occasioned by the prick of the lancet; but, erysipelas of the skin ending in gangrene of the whole limb, and the death of the patient. (See *Richerand's Nosog. Chir. Tom. 2, p. 390, Edit. 2.*) A case, in which the greater part of the integuments of the arm, had been destroyed by erysipelas, thus produced, I lately saw under the care of Mr. Vincent, in St. Bartholomew's hospital.

In former times, it was customary to refer many of the bad symptoms occasionally following venesection, to a puncture of the tendon of the biceps; but, this doctrine is now in a great measure renounced, the experiments of Haller having completely proved, that tendons and aponeuroses are, comparatively speaking, parts endued with little or no sensibility.

In the foregoing account, the various ill consequences occasionally arising after ven-

ne section are represented separately; no doubt, in some cases, they may occur together.

See R. Butler's *Essay concerning Blood-letting*, &c. 8vo. Lond. 1734. M. Martin, *Traité de la Phlébotomie et de l'Artériotomie*, 8vo. Paris, 1741. Quesnay, *Traité des Effets et de l'Usage de la Saignée*, 12mo. Paris. G. Vieussieux, *De la Saignée, et de son Usage dans la plupart des Maladies*, 8vo. Paris, 1815. J. J. Walbaum, *De Venæsectione*, Gott. 1749. (Haller *Disp. Chir.* 5, 477.) B. Bell's *System of Surgery. Essay on the ill Consequences, sometimes following Venæsection*, by J. Abernethy. *Medical Communications*, Vol. 2. Richerand's *Nosographie Chirurgicale*, Tom. 2, p. 416, Edit. 4. M. Freteau, *Traité Elementaire Sur l'Emploi legitime et methodique des Emissions Sanguines*, &c. 8vo. Paris, 1816. Mapleson's *Treatise on the Art of Cupping*, 12mo. Lond. 1813; and Dr. J. R. Johnson's valuable *Treatise on the Medicinal Leech, including its Medical and Natural History, with a description of its Anatomical Structure, and Remarks upon the Diseases, Preservation, and Management of Leeches*, 8vo. Lond. 1816.

BLEEDING. (See Hemorrhage and Arteries.)

BLE'NORRHAGIA, or *Blénorrhœa*. (From *ῥανος*, mucus, and *εἶω*, to flow.) A discharge of mucus. Swediaur, who maintains, that gonorrhœa is attended with a mucous, and not a purulent discharge, prefers the name of blenorragia for the disease. However, in treating of gonorrhœa, we shall find that this last appellation is itself not altogether free from objections.

BLEPHAROPTOSIS. (From *βλεφαρον*, the eyelid, and *πτωσις*, a falling down.) Called also *ptosis*. An inability to raise the upper eyelid. (See *Ptosis*.)

BLEPHAROTIS. An inflammation of the eyelids.

BLINDNESS. This is an effect of many diseases of the eye. See, particularly, *Amaurosis*; *Cataract*; *Cornea*, *Opacities of*; *Gutta Serena*; *Hydrophthalmia*; *Leucoma*; *Ophthalmia*; *Pterygium*; *Pupil, closure of*; *Staphyloma*, &c.

BLISTERS. Topical applications, which, when put on the skin, raise the cuticle in the form of a vesicle, filled with a serous fluid. Various substances produce this effect on the skin; but the powder of cantharides is what operates with most certainty and expedition, and is now invariably made use of for the purpose. The blister plaster is thus composed; *R Cantharidum* ℞j. *Emplastrum cere* ℞iiss. *Adipis suille præp.* ℞j. The wax plaster and lard being melted, and allowed to become nearly cold, the powdered cantharides are afterwards to be added.

When it is not wished to maintain a discharge from the blistered part, it is sufficient to make a puncture in the cuticle to let out the fluid; but when the case requires keeping up a secretion of pus, the surgeon must remove the whole of the detached cuticle with a pair of scissors, and dress the exco-

riated surface in a particular manner. Practitioners used formerly to mix powder of cantharides with an ointment, and dress the part with this composition. But such a dressing not unfrequently occasioned very painful affections of the bladder, a scalding sensation in making water, and most afflicting stranguries. An inflammation of the bladder, ending fatally, has been thus excited. The treatment of such complaints consists in removing every particle of cantharides from the blistered part, which is to be well fomented, and making the patient drink abundantly of mucilaginous drinks. Camphor is now suspected to prove more hurtful than useful.

These objections to the employment of salves, containing cantharides, for dressing blistered surfaces, led to the use of meze-reon, euphorbium, and other irritating substances, which, when incorporated with ointment, form very proper compositions for keeping blisters open, without the inconvenience of irritating the bladder, like cantharides.

The favourite application, however, for keeping open blisters, is the powder of savine, which was brought into notice by Mr. Crowther, in the first edition of his book on the White Swelling. In the last edition, this gentleman remarks, that he was led to the trial of different eschorative applications, in the form of ointment, in consequence of the minute attention, which caustic issues demand; and among other things, he was induced to try powdered savine, from observing its effects in the removal of warts. Some of the powder was first mixed with white cerate, and applied as a dressing to the part, that had been blistered; but the ointment ran off, leaving the powder dry upon the sore, and no effect was produced. Mr. Crowther next inspissated a decoction of savine, and mixed the extract with the ointment, which succeeded better, for it produced a great and permanent discharge. At last, after various trials, he was led to prefer a preparation analogous to the unguentum sambuci P. L. and he now offers the following formula, as answering every desirable purpose: *R Sabina recentis conturæ* lbj, *Ceræ flavæ* lbj, *Adipis suille* lbiv. *Adipe et cera liquefactâ, incoque sabinam et cola.*

The difference of this formula from that, which Mr. Crowther published in 1797, only consists in using a double proportion of the savine leaves. The *ceratum sabinæ* of Apothecary's Hall, he says, is admirably made: the fresh savine is bruised with half the quantity of lard, which is submitted to the force of an iron press, and the whole is added to the remainder of the lard, which is boiled until the herb begins to crisp; the ointment is then strained off, and the proportion of wax, ordered, being previously melted, is added. On the use of the savine cerate, immediately after the cuticle raised by the blister, is removed, it should be observed, says Mr. Crowther, that experience has proved the advantage of using the appli-

ration lowered by a half, or two-thirds, of the unguentum ceræ. An attention to this direction will produce less irritation and more discharge, than if the savine cerate were used in its full strength. Mr. Crowther says also, that he has found fomenting the part with flannel wrung out of warm water, a more easy, and preferable way of keeping the blistered surface clean, and fit for the impression of the ointment, than scraping the part, as has been directed by others. An occasional dressing of the unguentum resinæ flavæ, he has found, a very useful application for rendering the sore free from an appearance of slough or rather dense lymph, which has sometimes been so firm in its texture, as to be separated by the probe, with as much readiness, as the cuticle is detached after blistering. As the discharge diminishes, the strength of the savine dressing should be proportionally increased. The ceratum sabinæ must be used, in a stronger, or weaker degree, in proportion to the excitement produced on the patient's skin. Some require a greater stimulus, than others, for the promotion of the discharge, and this can only be managed by the sensations, which the irritation of the cerate occasions.

Mr. Crowther had used ointments, containing the flowers of the elematis recta, the capsicum, and the leaves of the digitalis purpurea. The two first produced no effect: the last was very stimulating; and Mr. Crowther mentions his intention to take the first convenient opportunity to determine its qualities more accurately. He has also used caustic potassa, mixed with spermaceti cerate, in the proportion of one dram to an ounce: it proved very stimulating, but produced no discharge. He has tried one dram of the oxymuriate of mercury, blended with two ounces of the above cerate; but the application was so intolerably painful, that at the end of two hours, it became necessary to remove the dressing; and the patient was attacked with a most severe pytalism. (*Practical Observations on the White Swelling, &c., a new edition, by B. Crowther, 1808.*)

Instead of keeping a blister open, it is frequently a judicious plan to renew the application of the emplastrum lyttæ, after healing up the vesication first produced, and to continue, in this manner, a succession of blisters, at short intervals, as long as the circumstances of the case may demand. Where the skin is peculiarly irritable, and, particularly, in young children, where the emplastrum lyttæ sometimes acts so violently as to produce sloughing, or, in any cases, where the plaster produces stranguary and irritation of the urinary organs, I am informed, that the inconvenience may be avoided, and the cuticle raised very well, if a piece of silk paper be interposed between the plaster and the integuments. Mr. A. T. Thompson recommends for the same purpose a piece of thin gauze, wet with vinegar, and applied smoothly and closely over the plaster. (*Dispensatory, p.*

717, *Ed. 2.*) For infants, a proportion of opium has sometimes been added to the emplastrum lyttæ, in order to render its action less violent; a proposal made I believe, by Mr. Chevalier.

BOIL. (See *Furunculus*.)

BONES, Diseases of; See *Antrum*; *Caries*; *Exostosis*; *Joints*; *Mollities*; *Necrosis*; *Osteosarcoma*; *Rickets*; and *Veneral Disease*. The following works, relative to the pathology of the bones, deserve notice:—F. C. Spoendli, *De Sensibilitate Ossium Morbosa*, 4to. Gott. 1814. A. Murray, *De Sensibilitate Ossium Morbosa*; (*Ludov. Script. Neur. 4.*) O. Marray, *Diss. Acad. de Sensibilitate Ossium Morbosa*. (Frank. Del. Op. 12.) J. G. Sturm, *De Vulneribus Ossium*. Helmst. 1743. A. Bonn, *Tab. Ossium Morbosorum præcipue Thesauri Hoviani*, fol. Amst. 1785, 88. C. F. Clossius, *ueber die Krankheiten der Knochen*, 12mo. Tubing. 1799. A. G. Naumann, *De Ostioidie*, 4to. Lips. 1818. R. Nesbitt, *Human Osteogeny*; two lectures on the nature of Ossification, 8vo. Lond. 1736. Sandifort *Museum Anatomicum Lugduno Batavæ Descriptum*, 2 Vol. fol. Lugd. 1793. Weidmann, *De Necrosi Ossium*, fol. Francof. 1793. Brodie on *Diseases of Joints*, 8vo. Lond. 1818. Howship in *Med. Chir. Trans.* and various other publications specified at the end of the article *Necrosis*.

BOUGIE,—Is a smooth flexible instrument, which is introduced into the urethra for the cure of diseases of that passage: (See *Urethra*) and is so named from its generally containing wax in its composition, and bearing some resemblance to a wax taper, in French, bougie. However, the kinds of bougies are various, and some of them, employed in modern surgery, so far from having any similitude to a wax taper, are formed altogether of metal. They admit of being divided into those which are solid; and others, which are hollow, and are more commonly named catheters. (See *Catheter*.)

The exact period when bougies were first used is a doubtful point in the history of surgery. By Andrew Lacuna, a Spanish physician, the invention is ascribed to a Portuguese empiric, and in 1551, the same author published what had been communicated to him upon this subject. In the year 1554, Amatus Lusitadus published a work, in which he refers to several witnesses to prove, that the empirical practitioner, above alluded to, had learned from him the use of bougies, while, on the other hand, he candidly owns, that he himself was indebted to Aldereto, of Salamanca, for a knowledge of these instruments. In 1553, however, Alph. Ferri, of Naples, endeavoured to show, that his acquaintance with the utility of bougies reached as far back as 1548, and, of course, that he had anticipated Lacuna, and perhaps even Aldereto. But, instead of representing himself as the original inventor of bougies, he mentions that they were known to Alexander of Tralles, which, if true, carries back the invention to the sixth century. A. Ferri.

also, before describing bougies and escharotic ointments, mentions various means for examining the state of the urethra, and, among other things, cylinders made of flexible lead, and of different sizes. Escharotic ointments for what were termed *carinosities* of the urethra, and bougies were also described by Petronius in 1565, and afterwards by A. Paré. The oldest bougies, which were wicks of cotton, or thread, covered with wax, and escharotic plasters, were in time succeeded by those composed of linen smeared with wax. This change was made with the view of letting them have a hollow construction: an improvement, which was first noticed by Fabricius ab Aquapendente. (*Op. Chir.* 1617.)

In the middle of the 17th century, the manner of making and using bougies was well known to Scultetus, as appears from his *Armamentarium Chirurg.* tab. 13, fig. 9, 10.

The making of bougies has now become so distinct a trade, that it may be considered superfluous to treat of the subject in this dictionary. However, though a surgeon may not actually choose to take the trouble of making bougies himself, he should understand how they ought to be made. Swediaur recommends the following composition: *R. Cere flavæ lbj, Spermat. ceti Ziij. Cerussæ acetatæ 3v.* These articles are to be slowly boiled together, till the mass is of proper consistence. Mr. B. Bell's bougie plaster is thus made: *R. Emplastri lythargyri 3iv, Cere flavæ 3iss, Olei Olivæ Ziij.* The two last ingredients are to be melted in one vessel, and the litharge plaster in another, before they are mixed. In Wilson's *Pharmacopœia Chirurgica*, I observe this formula: *R. Olei Olivæ lbiss, Cere flavæ lbj, Minii lbiss.* Boil the ingredients together over a slow fire, till the minium is dissolved, which will be in about four or six hours. The composition for bougies is now very simple, as modern surgeons place no confidence in the medicated substances, formerly extolled by Daran. The linen, which may be considered as the basis of the bougie, is to be impregnated with the composition, which is generally wax and oil, rendered somewhat firmer by a proportion of resin. Some saturnine preparation is commonly added, as the urethra is in an irritable state, and the mechanical irritation might otherwise increase it. Of whatever composition bougies are made, they must be of different sizes, from that of a knitting-needle to that of a large quill, and even larger. Having spread the composition, chosen for the purpose, on linen rag, cut this into slips, from six to ten inches long, and from half an inch, to an inch, or more in breadth. Then dexterously roll them on a glazed tile into the proper cylindrical form. As the end of the bougie, which is first introduced into the urethra, should be somewhat smaller than the rest, the slips must be rather narrower in this situation, and, when the bougies are rolled up, that

side must be outward, on which the plaster is spread.

Daran, and some of the older writers, attributed the efficacy of their bougies to the composition used in forming them. On the contrary, Mr. Sharp apprehended that it was chiefly owing to the pressure, which was made on the affected part; and Mr. Aikin adds, that as bougies of very different compositions, succeed equally well in curing the same diseases in the urethra, it is plain, that they do not act from any peculiar qualities in their composition, but by means of some common property, probably, their mechanical form.

As the healthy as well as the diseased parts are exposed to the effects of bougies made of very active materials, modern surgeons always prefer such as are made of a simple unirritating composition.

Plenck recommended bougies of catgut, which may be easily introduced into an urethra, even when it is greatly contracted, their size being small, their substance firm, and dilatable by moisture. It is objected to catgut, however, that it sometimes expands beyond the stricture, and gives great pain on being withdrawn. Formerly, catgut bougies were sometimes coated with elastic gum, a valuable material of which I shall next speak.

The invention of elastic bougies and catheters originated with Bernard, a silversmith at Paris, who, in the year 1779, presented some instruments of this kind to the Academy of Surgery, which period was prior to the claim made by Professor Pickel of Wurzburg to the discovery. (*See Journ. de Med. an.* 1785.)

For the composition of bougies, elastic resin, or gum, is thought to be very desirable, as it unites firmness and flexibility. Mr. Wilson, in his *Pharmacopœia Chirurgica*, is inclined to think that the art of making these instruments, consists in finding a suitable solvent for the indian gum. As this substance, if dissolved in æther, completely recovers its former elasticity, upon the evaporation of this fluid, it is supposed that æther, though rather too expensive, would answer.

I find it positively asserted, however, in a modern work of great repute, that the idea of elastic gum, being the substance really employed, is a mistake, as the material used is nothing more than linseed oil, boiled for a considerable time, and used as a varnish for the silk, linen, or cotton tube. (*See Dict. des Sciences Méd. art. Bougie.*)

Very cheap and good elastic gum bougies are made by Feburier, No. 51, Rue du Bac at Paris, who has twelve different sizes. His elastic gum catheters are also well made, though, for smoothness and regularity, I think they are not equal to some, which are now constructed in London, but I believe, Feburier's smallest size is rather less than any which are made in this city; an advantage which no doubt our artists will soon be able to give their productions. This ingenious mechanic does not employ

catgut in the composition of the elastic gum bougies, for which he is so celebrated. These bougies are most excellent, when you can get them to pass; for they dilate the stricture with the least possible irritation. But, sometimes, they cannot be introduced, when a wax bougie can; and from the trials which I have made of them, I conceive this arises from their elasticity and continual tendency to become straight, when they reach the perinæum, so that the point presses on the lower surface of the urethra. Hence, when the obstruction is on that side, it must be very difficult to get the end of the bougie over it.

A few years ago, Mr. Smyth discovered a metallic composition, of which he formed bougies, to which some practitioners impute very superior qualities. These bougies are flexible, have a highly polished surface, of a silver hue, and possess a sufficient degree of firmness for any force necessary in introducing them for the cure of strictures in the urethra. The advocates for the metallic bougies assert, that such instruments exceed any other bougies, which have yet been invented, and are capable of succeeding in all cases, in which the use of a bougie is proper. They are either solid, or hollow, and are said to answer extremely well as catheters; for, they not only pass into the bladder with ease, but may also be continued there for any convenient space of time, and thus produce essential benefit. (*W. Smyth, Brief Essay on the Advantages of flexible Metallic Bougies, 8vo. Lond. 1804.*) The greatest objection, which has been urged against them, is, that they are attended with a risk of breaking. I have heard of an eminent surgeon being called upon to cut into the bladder, in consequence of a metallic bougie having broken, and a piece of it got into that organ, where it became a cause of the severe symptoms which are commonly the effect of a stone in the bladder. For the particulars of an interesting case, in which a metallic bougie broke in the urethra, the reader may consult *London Med. Repository, Vol. 9, No. 51.* It has also been objected to metallic bougies, that, although they are sufficiently flexible, they are quite destitute of elasticity.

The bougie, with its application, says Mr. Hunter, is perhaps one of the greatest improvements in surgery, which these last thirty or forty years have produced. When I compare the practice of the present day, with what it was in the year 1750, I can scarcely be persuaded, that I am treating the same disease. I remember, when, about that time, I was attending the first Hospitals in the city, the common bougies were, either a piece of lead or a small wax candle, and, although the present bougie was known then, the due preference was not given to it, nor its particular merit understood, as we may see from the publications of that time.

Daran was the first, who improved the bougie, and brought it into general use.—He wrote professedly on the diseases for

which it is a cure, and also of the manner of preparing it, but, he has introduced much absurdity into his descriptions of the diseases, the modes of treatment, and the powers and composition of his bougies.

When Daran published his observations on the bougie, every surgeon set to work to discover the composition, and each conceived that he had found it out, from the bougies, which he had made, producing the effects described by Daran. It never occurred to them, that any extraneous body, of the same shape and consistence, would do the same thing. (*See a Treatise on the Venereal Disease, p. 116. Sharp's Critical Inquiry, Ch. 4; Aikin on the External Use of Lead; Daran Obs. Chir. Sur les Maladies de l'Urethre, 12mo. Paris, 1748, and 1768; Olivier, Lettre dans laquelle on démontre les avantages, que l'on peut retirer de l'usage des bougies creuses, &c. 8vo. Paris, 1750; Desault, Journ. de Chir. T. 2, p. 375, and T. 3, p. 123, 1792; Smyth's Brief Essay on flexible metallic bougies, 8vo. Lond. 1804; Dict. des Sciences Medicales, T. 3, p. 265, &c. 8vo. Paris, 1812.*)

Of armed bougies, as well as of some other kinds, of the manner of using bougies in general, I shall speak in the article *Urethra, Strictures of.*

BRAIN. (For concussion, compression of, &c. see *Head, Injuries of*; for the hernia of, see *Hernia Cerebri.*)

BREAST. (See *Mammary Abscess; Mamma, Removal of; Cancer, &c.*)

* **BRONCHOCELE.** (from *βρογχος*, the windpipe, and *κελε*, a tumour.) Also called *botium*, or *bocium*. The Swiss call the disease *gotre*, or *goitre*. Some have called it, *hernia gutturis*; *guttur tumidum*; *tracheophyma*; *gossum*; *excehebronchos*; *gongrona*; *hernia bronchialis*. Heister thought it should be named *tracheocele*. Prosser, from its frequency on the hilly parts of Derbyshire, called it the *Derbyshire neck*; and not satisfied respecting the similitude of this tumour to that observed on the necks of women on the Alps, the *English Bronchocele*. By Alibert the disease is called *Thyrophraxia*.

1. The simple bronchocele or thyrophraxia, is the most common form of the disease, and is a mere enlargement of the thyroid gland. The integuments covering the part, are quite unchanged. Women are observed to be more subject to it than men. It is also well known to be in general free from danger, the office of the thyroid gland not being of such importance in the animal economy, as to be essential to the continuance of life. Alibert assures us, however, that he has seen one example, in which the tumour became cancerous, and destroyed the mother of a family.

2. The compound bronchocele is that which presents the greatest variety, and astonishes every beholder. Sometimes a more or less voluminous cyst is formed round it, filled with a pultaceous, or purulent matter. Sometimes, in compound bronchoceles, calcareous, and other heterogeneous substances are found. In two ca-

ses, Alibert observed, on the outside of the enlarged gland, a yellow fatty mass; and, in a third instance, the gland itself formed a true sarcoma. (*Nosologie Naturelle*, T. 1, p. 464—465, folio, Paris, 1817.)

The term *bronchocele*, always signifies in this country, an enlargement of the thyroid gland, which, with the disease of the surrounding parts, sometimes not only occupies all the space from one angle of the jaw to the other, but forms a considerable projection on each side of the neck, advancing forward a good way beyond the chin, and forming an enormous mass which hangs down over the chest. The swelling, which is more or less unequal, in general has a soft spongy elastic feel, especially when the disease is not in a very advanced state; but, no fluctuation is usually perceptible, and the part is exceedingly indolent. The skin retains nearly its ordinary colour; but, when the tumour is of very long standing, and great size, the veins of the neck become more or less varicose.

According to Prosser, the tumour generally begins between the eighth and twelfth years. It enlarges slowly during a few years, till, at last, it augments rather rapidly, and forms a bulky pendulous tumour. Women are far more subject to the disease, than men, and the tumour is observed to be particularly apt to increase rapidly during their confinement in childbed. Sometimes bronchocele affects the whole of the thyroid gland, that is to say, the two lateral lobes, and the intervening portion, and it is in this kind of case, that it is not unusual to remark three distinct swellings, for the most part of unequal size. Frequently, only one lobe is affected; while, in many cases, the three portions of the thyroid gland are all enlarged, and so confounded together, that they make, as it were, only one connected globular mass. Finally, in some dissections, the thyroid gland has been found quite unchanged, the whole of the tumour having consisted of a sarcomatous disease of the adjacent lymphatic glands and cellular membrane. (*Postiglione*, p. 21.) When only one lobe of the thyroid gland is affected, it may extend in front of the carotid artery, and be lifted up by each diastole of this vessel, so as to appear to have the pulsatory motion of an aneurism. (*A. Burns's Surgical Anatomy of the Head and Neck*, p. 195, and *Parisian Chirurgical Jour.* Vol. 2, p. 292, 293.) Alibert believes, that he first made the remark, that the right lobe was more frequently enlarged than the left. (*Nosol. Nat.* T. 1, p. 465.)

The ordinary seat of bronchocele, as Flajani remarks, is in the thyroid gland; but sometimes cysts are formed in the cellular membrane. (*Collez. d' Oss.* T. 3. p. 277.) And Postiglione also observes, that the swelling is sometimes encysted, and filled with matter of various degrees of consistence, resembling honey, &c.; in some cases, it is emphysematous, or filled with air; and, in other instances, it is sarcomatous, having the consistence of a gland,

which is enlarged, but not scirrhus.—These different characters, says he, indicate, that the treatment ought not to be the same in all cases. (*Memoria sulla Natura del Gozzo*, p. 20.)

Bronchocele is common in some of the valleys of the Alps, Appenines and Pyrenees. Indeed, there are certain places, where the disease is so frequent, that hardly an individual is totally exempt from it. Larrey, in travelling through the valley of Maurenne, noticed, that almost all the inhabitants were affected with goitres of different sizes, whereby the countenance was deformed, and the features rendered hideous. (*Mém. de Chir. Mil.* T. 1, p. 123.)—And Postiglione remarks, that in Savoy, Switzerland, the Tyrol, and Carinthia, there are villages, in which all the inhabitants without exception have these swellings, the position and regularity of which are there considered as indications of beauty. (*Memoria sulla Natura del Gozzo*, p. 22.) In many, the swelling is so enormous that it is impossible to conceal it by any sort of clothing. A state of idiotism is another affliction, which is sometimes combined with the *goitre*, in countries where the latter affection is endemic. However, all, who have the disease, are not idiots, nor cretins, as they have been called, and in Switzerland, and elsewhere, it is met with in persons who possess the most perfect intellectual faculties. Where bronchocele and cretinism exist together, Foderé, and several other writers, ascribe the affection of the mind to the state of the thyroid gland. (*See Traité sur le Goitre et le Cretinisme*, *Svo. Paris*, an. 8.) This opinion, however, appears to want foundation, since the mental faculties are from birth weak, and, in many, the idiotism is complete, where there is no enlargement of the thyroid gland, or where the tumour is not bigger than a walnut, so that no impediment can exist to the circulation to, or from the brain. (*Burns on the Surgical Anatomy of the Head and Neck*, p. 192.) The direct testimony of Dr. Reeve also proves, that, in the countries where cretins are numerous, many people of sound and vigorous minds have bronchocele. (*See Dr. Reeve's Paper on Cretinism*, *Edin. Med. and Surgical Journal*, Vol. 5, p. 31.) Hence, as Mr. A. Burns has remarked, the combination of bronchocele and cretinism must be considered as accidental; a truth, that seems to derive confirmation from the fact, that, in some parts of this country, bronchocele is frequent, where cretinism is seldom or never seen. In the valleys of several mountainous countries, particularly Switzerland, Savoy, the Tyrol, Carinthia, Derbyshire, &c. bronchocele is endemic; and it occurs remarkably often in young subjects, and much more frequently in the female than the male sex.

Bronchocele is a disease not confined to Europe: it is met with in almost every country on the globe. Professor Barton, in his travels among the Indians, settled at Oneida, in the state of New-York, saw

the complaint in an old woman, the wife of the chief of that tribe. From this woman Barton learned, that bronchoceles were by no means uncommon among the Oneida Indians, the complaint existing in several of their villages. He found, also, that the disease resembled that seen in Europe, in respect to its varieties. He did not indeed himself see the pendulous bronchocele, which descends over the breast; but, he understood, that it was not uncommon among the women on the banks of the Mohawk river, who wore a particular dress for its concealment. In North America, bronchocele attacks persons of every age; but, it is most frequently seen in adults; a difference from what is noticed in Europe. Bronchocele is said to be frequent in Lower Canada. Bonpland, the companion of Humboldt, informed Alibert, that the disease was endemic in New Grenada, and that it prevailed in such a degree in the little towns of Hunda and Monpa, on the banks of the Magdalen river, that scarcely any of the inhabitants were free from it.—The blacks, and those who led an active laborious life, however, are reported not to have been affected. Some of the natives of the Isthmus of Darien, are said also to be terribly disfigured by this disease. (*Alibert, Nosol. Nat. T. 1, p. 469.*)

In European women, bronchocele usually makes its appearance at an early age, generally between the eighth and twelfth year, and it continues to increase gradually for three, four, or five years, and is said sometimes to enlarge more, during the last half year, than for a year, or two previously. It does not generally rise so high as the ears, as in the cases mentioned by Wiseman. Sometimes, however, this happens, as we see in the case of Clement Desenne, of whom Alibert has given an engraving. In this patient, a part of the tumour, as large as a hen's egg, projected into the mouth. (*Nosol. Nat. T. 1, p. 466.*) The swelling extended from the ears to the middle of the breast. A seton produced a partial subsidence of it; but, when it was withdrawn, the orifices closed. After two years more, the swelling became painful, suppuration took place, and fifteen pints of matter were discharged; and six ounces every day after the swelling had burst, came away with the dressings for three months, but, notwithstanding all this suppuration, and more afterwards, the tumour was only partially lessened. The disease mostly has a pendulous form, not unlike, as Albucasis says, the flap or dewlap of a turkey cock, the bottom being the largest part of the tumour. Alibert mentions a case, in which the swelling hung down to the middle of the sternum, and the large mass, which was quite a burden to the patient, used to become hard, and as it were frozen, in very cold weather. This author, however, cannot be right, when he adds, that it was an inert body, *destitute of vitality!* (*Nosol. Nat. T. 1, p. 466.*) In another curious instance, the tumour formed

a long cylinder, which reached down to the middle of the thigh, the diameter becoming gradually smaller downwards. (*p. 468.*) As a modern author has remarked, the common seat of bronchocele is in the thyroid gland; but, frequently, the surrounding cellular membrane is more or less thickened, and contributes to the swelling. Sometimes also the neighbouring lymphatic glands are affected, when its base is widened, and extends from one side of the neck to the other. In this circumstance, the swelling gradually loses itself in the surrounding parts, and is not circumscribed, as in ordinary instances. (*Postiglione Mem. sulla Natura del Gozzo, p. 20.*) It is soft, or rather flabby to the touch, and somewhat moveable, but after a few years, when it has ceased enlarging, it becomes firmer, and more fixed. When the disease is very large, it generally occasions a difficulty of breathing, which is increased on the patient's catching cold, or attempting to run. In some subjects, the tumour is so large, and effects the breathing so much, that a loud wheezing is occasioned; but, there are many exceptions to this remark. Sometimes, when the swelling is of great size, patients suffer very little inconvenience; while others are greatly incommoded, though the tumour may be small. In general, the inconvenience is trivial. The voice is sometimes rendered hoarse, and, in particular cases, the difficulty of speech is very considerable. (*See Flajani Colles. d'Oss. T. 3, p. 271.*)

The difficulty of respiration, produced by the pressure of the tumour, and the enlargement of other glands, as this author remarks, is the most dangerous effect of the disease, since by disordering the pulmonary circulation, it renders the pulse irregular and intermittent, and a strong throbbing is excited in the region of the heart, followed by fatal disease of the lungs themselves: consequences, often not suspected to have any connexion with the bronchocele, though it is in reality the immediate cause of them. (*Vol. Cit. p. 278.*)

The causes of the bronchocele are little known. To the opinion that bronchocele is caused by the earthy impregnation of water used for drink, the following objections offer themselves. 1. The water of Derbyshire, in districts, where this disease is considered endemic, contains much supercarbonate of lime; but that in common use about Nottingham, where the disease is also prevalent, is impregnated with sulphate of lime. However, that the disease is not produced by water, impregnated with sulphate of lime, is evident; for, as Alibert observes, the waters of Saint-Jean, Saint-Sulpice, and St. Pierre, where bronchocele is frequent, contain much less of this earth than the waters of Upper Maurienne, where the disease is hardly ever noticed, though the houses are built upon a vast quarry of gypsum. The same fact was observed by Bonpland in New Grenada. (*Nosol. Nat.*

T. 1, p. 471.) Nor, as Foderé explained, can the cause of the disease be correctly referred to the use of any particular kind of food. Certain localities, however, seem to contribute to its frequency; for, this author observed, that the disease is not prevalent in very high places, nor in open plains; but, that it becomes more and more common, as we descend into deep valleys, made by torrents, where there is a good deal of marsh, and abundance of fruit trees. The air is here constantly humid. 2. Abstinence from water unboiled does not diminish, nor interrupt the gradual progress of the disease. 3. Patients are cured of the disease, who still continue to drink water from the same source as before, without taking any precaution, as boiling, &c. 4. The disease in this country is less frequently found among men. 5. Many instances may be related of a swelling in the neck, sometimes very painful, and generally termed bronchocele, being produced very suddenly, by difficult parturition, violent coughing, or any other unusually powerful effort. (See *Edin. Med. and Surgical Journal*, Vol. 4, p. 279.) When the gland is suddenly enlarged during a violent exertion, the distention is said to be produced by the passage of air from the trachea into the substance of the thyroid gland, and surrounding cellular membrane. But, whether this statement be a fact or not, it is unquestionably true, that, in many patients, the tumour always becomes increased in size, when they speak loud, sing, or make any effort. (*Flajani Collez. d'Oss. &c. T. 3, p. 276*, and *Postiglione, p. 24*.) The disease is sometimes seen in scrofulous subjects; but, there is every reason to believe, that it is quite independent of the other disorder, as Prosser, Wilmer, and Kortum have particularly explained. The following are some points of difference, between bronchocele and scrofula, as indicated by Dr. Postiglione. 1. The true bronchocele is simply a local disease of the neck, the constitution being unaffected.—On the contrary, scrofula extends its effects to the whole system, attacking not only the lymphatic glands, but also the muscles, the cellular membrane, the ligaments, cartilages, and bones. 2. Both diseases chiefly occur in young subjects; but, bronchocele often begins at a later age, than scrofula, and does not, like the latter, spontaneously disappear, as the patient approaches puberty, and gains strength. 3. Scrofulous glands often suppurate and ulcerate; bronchocele rarely undergoes these changes. 4. The thickening of the upper lips of scrofulous subjects, is not an attendant on bronchocele; and, while the former patients generally enjoy their mental faculties in perfection, as long as they live, the latter disease in certain countries is often joined with cretinism. Scrofula is likewise always hereditary; while bronchocele is not so; no healthy persons become scrofulous by living a long while among scrofulous patients; but many individuals contract bronchocele by going from a country where

this disease is unknown, and taking up their residence in places where it abounds. 5. Nature alone often cures scrofula, while art seldom succeeds; on the contrary, bronchocele is seldom cured by nature, but very frequently by art. 6. The muriate of lime, recommended by Fourcroy for the cure of scrofula, is always useless: but, in bronchocele, it proves a valuable remedy. (*Postiglione Memoria sulla Natura del Gozzo, &c. p. 25*.) The error of confounding bronchocele with scrofula, is now generally acknowledged. At the hospital St. Louis, says Alibert, scrofulous patients are very numerous, while those with bronchocele are very rare. (*Nosol. Nat. T. 1, p. 465*.) On the mountainous parts of Derbyshire, Genoa, and Piedmont, they attribute the bronchocele to drinking water cooled with ice. To this theory, many of the objections, concerning the earthy impregnation of water, stand in full force; with this additional reflection, that "In Greenland, where snow water is commonly used, these unsightly protuberances are never met with, nor, (says Watson), did I ever see one of them in Westmoreland, where we have higher mountains, and more snow than they have in Derbyshire, in which county, they are very common. But what puts the matter beyond a doubt, is, that these wens are common in Sumatra, where there is no snow, during any part of the year." (*Watson's Chymical Essays, Vol. 2, p. 157*.) The above opinion was also refuted by Foderé, who remarks, that the Swiss, who reside at the bottom of the Glaciers, are the least subject to the disease. Bronchoceles are also said to be unknown in Lapland.

Respecting the influence of particular water in bringing on the disease, Dr. Odier gives credit to the opinion, because it has appeared to him, that distilled water prevented the increase of the tumour, and even tended to lessen its bulk. (See *Manuel de Médecine Pratique, Soc. Gener. 1811*.) However, without denying this power of distilled water, I think the foregoing considerations satisfactorily prove, that the disease neither proceeds from snow water, nor water impregnated with particular salts.

An observation, lately made by an intelligent writer, would lead one to conclude, that cretinism depends upon malformation of the head. Speaking of goitre, as it appears among the inhabitants of the valley of Maurienne, Baron Larrey informs us, that, in many of these people, with this frightful deformity is joined that of the cranium, of which the smallness and excessive thickness are especially remarkable. (*Mem. de Chir. Mil. T. 1, p. 123*.) Dr. Leake thinks, that tumours of this sort may be owing to the severity of the cold damp air, as they generally appear in winter, and hardly ever in the warm dry climates of Italy and Portugal. The latter part of the observation, however, is not correct, for Dr. Postiglione and other Italian writers assure us, that the disease is extremely common in some of the warmest parts of Italy. "*Qui in Napo-*

li, e per tutto il regno, si veggono molti gozzuti, ma non in numerotale, come in Casoria, ed in pochi altri villaggi." (p. 21.) Prosser is inclined to consider the bronchocele, as a kind of dropsy of the thyroid gland, similar to the dropsy of the ovary, and he mentions, that Dr. Hunter dissected one thyroid gland, which had been considerably enlarged, and contained many cysts filled with water. These, he erroneously concludes, must have been hydatids. Dr. Baillie remarks, that when a section is made of the thyroid gland, affected with this disease, the part is found to consist of a number of cells, containing a transparent viscid fluid.

In all probability, the ordinary bronchocele is entirely a local disease, patients usually finding themselves, in other respects, perfectly well. The tumour itself frequently occasions no particular inconvenience, and is only a deformity. There is no malignancy in the disease, and the swelling is not prone to inflame, or suppurate, though, as Dr. Hunter remarks, abscesses do occasionally form in it. Alibert's case of bronchocele becoming cancerous is singular. Mr. Gooch never knew life to be endangered by this sort of tumour, however large, a remark very much at variance with the observations of some other practitioners; but, he had seen great inconvenience arise from it, when combined with quinsy. In fact, the pressure of a large bronchocele may not only greatly afflict the patient by rendering perspiration difficult, but actually cause death by suffocation. (See *Obs. sur un Goître volumineux, comprimant la Trachée-artère*; par L. Winslow, in *Bulletin de l'Athénée de Méd. &c.*) "Some persons, as Alibert remarks, have the disease all their lives without suffering any inconvenience from it; some experience a suffocating oppression of the breathing; and in others there is an impediment in the circulation, and a tendency to apoplexy, arising from the strangulation, which afflicts them. (*Nosol. Nat. T. 1, p. 446.*) Dr. Hunter says, that the bronchocele frequently appears two, or three years before, or after the commencement of menstruation, and that it sometimes spontaneously disappears, when this evacuation goes on in a regular manner. A. Burns affirms the same thing. On the contrary, according to Prosser, this change in the constitution hardly ever affects the tumour.

TREATMENT OF BRONCHOCELE.

That certain localities, perhaps not yet correctly understood, contribute to the origin of this disease, is well proved by a fact, stated by Alibert, viz. that change of air has more effect on the complaint than medicines, as he has known many Swiss ladies, who came to Paris with bronchoceles, in whom the tumour subsided after they had resided some time in that city.—(*Nosol. Nat. T. 1, p. 473.*)

A blister, kept open, has put a stop to the growth of the tumour; but, this method is not much followed at present, as a better plan of treatment has been discovered.—

The most famous mode of curing the bronchocele is by giving internally burnt sponge, and occasionally a calomel purge, at the same time, employing frictions to the tumour itself.

The efficacy of burnt sponge is said to be most conspicuous, when this medicine is exhibited in the form of a lozenge, composed of ten grains of this substance, ten of burnt cork, and the same quantity of pumice-stone. These powders are to be made into the proper form with a little syrup, and the lozenge is then to be put under the tongue and allowed to dissolve there. To the latter circumstance, much importance is attached. Other practitioners give a scruple of the burnt sponge alone, thrice every day, while some add a grain of calomel to each dose. A purge of calomel should be ordered about once a week, or fortnight, as long as the patient perseveres in the use of the calcined sponge; but, if mercury be combined with each dose of this medicine, no occasional purgative will be requisite.

External means may very materially assist the above internal remedies. Frequently rubbing the swelling with a dry towel; bathing the part with cold water; rubbing the tumour two or three times a day, with the liq. ammon. acet. or the camphor liniment; are the best steps of this kind which the surgeon can take.

"In the treatment of bronchocele," says Mr. A. Burns, "repeated topical detraction of blood from the tumour is highly beneficial. Electricity also has sometimes a marked effect; but, there is no remedy which I would more strongly advise, than regular and long-continued friction over the tumour. By perseverance in this plan, a bronchocele, treated in London, was materially reduced in the course of six weeks. Its good effects I have likewise witnessed myself; and it is a remedy highly recommended by Girard in his "*Traité des Loupes*." It has also been much used in scrofulous tumours by Mr. Grosvenor of Oxford, and by Mr. Russel of Edinburgh." (*Surgical Anatomy of the Head and Neck, p. 204.*)

Mr. A. Burns recommends the friction to be made with flannel, covered with hair powder, and the part to be rubbed, at least, three times a day, for twenty minutes.

In two cases of bronchocele, related by Dr. Clarke, the patients were cured, by "the steady use of the compound plaster of ammoniac and mercury, conjoined with the internal exhibition of the burnt sponge, and occasional purgatives." (See *Edinb. Med. and Surgical Journal. Vol. 4, p. 280.*)

We learn from Professor Odier, that in Geneva, the bronchocele is cured by burnt sponge, exhibited in powder, or infused in wine, and combined with purgatives to prevent the cramps of the stomach, which sometimes accompany the disappearance of the swelling. Muriate of barytes has likewise been recommended. (See *Manuel de Médecine Pratique.*)

A whole volume might be written on the various remedies, and plans of treatment, of

the bronchocele. The limits of this work, however, demand more conciseness, and, having detailed the most approved practice, we shall be very brief on other proposals.

Mr. Wilmer, credulously imputing great influence to the changes of the moon, used to begin with an emetic, the day after the full moon, and to give a purge the ensuing day. The night following, and seven nights successively, he directed the above-mentioned lozenge to be put under the tongue at bed-time, and administered every noon a bitter stomachic powder. On the eighth day, the purge was repeated, and, in the wane of the succeeding moon, the whole process, except the emetic, was renewed. (*Cases in Surgery, Appendix.*) This famous Coventry plan of treatment is said to be greatly assisted, by rubbing the tumour, with an ointment, containing tartar emetic.

Prosser succeeded with his medicines, though the patient was nearly twenty-five years old, and the swelling had existed more than twelve years. It is said, that no instance of cure has been known, after the patient was twenty-five. Prosser orders one of the following powders to be taken early in the morning, an hour or two after breakfast, and at five, or six o'clock in the evening, every day, for a fortnight, or three weeks. The powder may be taken in a little syrup, or sugar and water: \mathcal{R} . Cinnab. ant. op. levigat. milleped. ppt. et pulv. a a gr. xv. Spong. calcin. \odot M.

These powders should be taken for two, or three weeks, and then left off for a week or nine days, before a repetition. At bed-time, every night, during the second course of the powders, some purgative pills, composed of mercury, the extractum colocynthid. comp. and rhubarb, are to be administered; and in general it will be proper to purge the patient with manna, or salts, before beginning with the powders. Prosser puts no faith in external applications.

Some have recommended giving two scruples of calcined egg-shells, every morning, in a glass of red-wine; half a drachm of the sulphuret of potash every day, dissolved in water; or ten, or fifteen drops of the *tinct. digit. purpur.* twice a day, the dose to be gradually increased. Muriated barytes; cicuta; and belladonna, have also been exhibited. Postiglione commends the muriate of lime as a medicine possessing the greatest efficacy against this disease. He makes the remedy into a bolus with honey, to which he sometimes adds burnt sponge and cinnamon in powder. He employs also frictions with flannel, liniments, and sometimes purges with calomel. The bolus is placed under the tongue, and allowed to dissolve there. (*P. 59, &c.*)

Sir J. Wylie, physician to the Emperor of Russia, adopts the following treatment:—He directs 3 grains of the sub-muriate of mercury, 3 of the ammoniacal muriate of iron, 4 of burnt sponge, and 10 of the bark of laurus cassia. This powder is to be divided into twelve doses, one of which is given twice a week, with a gentle anodyne

at night. Sir J. Wylie likewise prescribes twenty-four lozenges, made by triturating an ounce of burnt sponge, with an equal quantity of the powder of gum arabic, and fifteen grains of cinnamon, first blended with a sufficient quantity of the syrup of orange peel. One of these lozenges is to be put under the tongue daily, and allowed to dissolve there. Lastly, to the tumour itself, he applies a plaster composed of half an ounce of litharge, a drachm of the submuriate of mercury, and 10 grains of antim. tartariz. (*Aliberti Nosol. Nat. T. 1, p. 474.*)

Some account of iodine, as a remedy for bronchocele, may be found in the London Med. Repository for Dec. 1820.

Petit, Heister, and Schmucker, make mention of inveterate bronchoceles, which got well gradually of themselves without much inconvenience, in consequence of the tumours suppurating. Volpi states, that such ulcerations are not unfrequent. He has published two facts of this kind, which occurred after a nervous fever; and he records a third case, where the swelling inflamed in consequence of a blow, and suppurated and sloughed, so as entirely to disappear. (See *Léveillé Nouvelle Doctrine Chir. T. 4, p. 128.*) A similar fact is recorded by Zipp. (*Siebold Samml. Chir. Beob. 2 B. p. 229.*)

The disease in its inveterate form, has also been sometimes removed by the application of caustic; (*Mesny in Journ. de Médecine, T. 24, p. 75; Timæus, Cas. p. 283.*) the establishment of issues; (*Jeitteles Obs. Med.*) the making of an incision into the swelling; or the introduction of a seton through it. (*Foderé Essai sur le Goitre et le Cretinisme, p. 75; Klein in v. Siebold Sammlung Chir. Beobacht. 2 B. p. 11; Flajani, Colezione a'Osservazioni di Chirurgia, T. 3, p. 283.*)

Bronchoceles have sometimes been removed by the part having been accidentally or purposely burnt to a considerable depth. (*Motte in Blegny Zodiac ann. 2 Febr. Obs. 11; Severinus de Efficaci Medicina, p. 220.*) The disappearance of bronchoceles has also been known to follow a wound. (*Schmidtmüller über die Ausführungsgänge der Schilddrüse, p. 37; Landshut, 1805.*) A Burns had sometimes employed blisters, and found them useful. (*Surgical Anatomy of the Head and Neck, p. 204.*) With respect to the caustic, which is spoken of by Celsus, *Lib. 7. cap. 13.*) Flajani states, that its operation is tedious and painful, and attended with danger, and what he says about the practice of an incision, is not more encouraging. Where the disease contains a cyst, he prefers making an opening with a trocar, though he confesses, that this plan is apt to be followed by a relapse, when the cyst is very thick and hard, in which circumstance, it will be necessary to have recourse either to an incision, or the seton, for the purpose of exciting suppuration. Should the disease, however, be merely composed of one cyst of moderate size, Flajani recommends its entire removal.

"Of all these methods," (says he) proposed for the extirpation of bronchoceles, the seton is the least dangerous, and by means of it a radical cure may be generally effected without any severe symptoms, as I have found by experience in many cases. On the contrary, I have been an eyewitness of the fatal consequences induced by the other plans. I was called to assist a gentleman, about forty years of age, brought to death's door by a bleeding, which arose from the application of caustic to the forepart of the neck. As tourniquets, bandages, &c. proved quite ineffectual, it was indispensable to make pressure on the part with the finger of an assistant, for twenty-four hours, ere the hemorrhage could be stopped; a copious suppuration ensued; and it was three months before the parts were healed. I was likewise present (says he) at the opening of a similar, but larger swelling in the same situation, the disease having afflicted an elderly respectable patient for several years. The incision caused the evacuation of a small quantity of serum, contained in the cellular membrane, but the following day, the tumour inflamed, the difficulty of respiration increased, and for some days, the patient was in great danger. At length suppuration was established, followed by a destruction of a great deal of the cellular membrane, and several sinuses, and, in five months, the patient lost his life. On examination of the body, the lungs were found tuberculated, an effect of the impediment to the circulation of the blood through the smaller vessels of those organs." (*Flajani Collezione a' Osserv. T. 3. p. 283, 8vo. Roma, 1802.*)

The first proposer of the employment of setons for the cure of diseases of the thyroid gland, is perhaps not exactly known; but it is certain, that the method has been known, and occasionally practised ever since the middle of the last century. "Dr. Monro, senior, (as a well-informed writer has observed) mentions in his lectures, that he had seen a dropsy in the centre of the gland, complicated with bronchocele, cured by a seton although the glandular swelling still continued." (*A. Burns on the Surgical Anatomy of the Head and Neck, p. 191.*) This statement is given on the authority of some MS. notes taken by Dr. Brown, from Dr. Monro's lectures. According to Girard, many cases in his time had been communicated to the Royal Academy of Surgery at Paris, in which the disease had been got rid of either by means of a seton, drawn through the swelling, or the application of an issue. (*Lapiologie, &c. 8vo. Paris, 1775.*) The occasional success of setons was also adverted to by Richter in the year 1788. (*Bibliothek, B. 9. p. 478.*) And, the plan is spoken of in another work, published in 1790, as being eligible, where the disease is conjoined with a cyst. (*Encyclopédie Méthod. Partie Chir. T. 1, p. 231.*) The practice was particularly noticed by Foderé in his valuable treatise on bronchocele; and Alibert mentions the seton as being used at

the Hospital St. Louis. (*Nosol. Nat. T. 1, p. 466, fol. Paris, 1817.*)

In November, 1817, Dr. Quadri, of Naples, tried this practice, which he erroneously supposed to be quite new. "By means of a trocar-pointed needle, six and a half inches long, I passed (says he) a seton from above downwards through the gland, at the depth of about four lines from its surface. Suppuration took place in forty eight hours. On the 18th of November, the seton escaped, when the matter was squeezed out, and the irritation, occasioned by replacing it, produced an abscess on the right side of the neck, which was opened on the 23d; when it was found, that the suppuration had effected the destruction of nearly the whole gland." The woman, who was thirty-six years of age, was seen by Dr. Somerville, in April 1818, with the circumference of her neck lessened, from sixteen to thirteen inches, French measure. In another case, referred to, a seton was passed through each side of the thyroid gland, and the result was a removal of the tumour on the side, where the seton was maintained long enough; but, on the opposite side, the seton being withdrawn too early, the matter collected in a sac, and at the end of four months, a sinus and discharge still continued, the patient refusing to have a counter opening practised. When the seton does not prove stimulating enough, Dr. Quadri sometimes enlarges it, or attaches to it escharotic, or irritating substances. He also frequently uses two setons. In one example, in endeavouring to perforate the gland rather deeply, Dr. Quadri appears to have injured the larger branches of the thyroid arteries, as more than an ounce of blood was discharged, and the tumour swelled, as if injected with blood. The bleeding, however, ceased spontaneously. He states, that the seton has been passed through the tumour not less than sixteen times, the direction being varied in every instance, without untoward accident, and he is confident, that, unless the needle be pushed deep enough almost to touch the thyroid cartilage, the trunks of the thyroid arteries will not be exposed to injury, while any branches, in the track of the needle, will not cause any danger. He insists also upon the propriety of retaining the seton in the tumour a considerable time, and observes, that it remains to be ascertained, whether this practice will answer in every description of bronchocele? For these and several other cases and particulars, the profession are indebted to Dr. Somerville. (See *Med. Chir. Trans. Vol. 10, p. 16, &c.*)

Mr. Gunning applied a seton in a case of bronchocele in St. George's Hospital; but, in this instance, the irritation brought on a sloughing ulceration, and the patient after a time died. The particulars of this case, and of two successful examples of the practice in England, will no doubt be detailed in the 11th volume of *Med. Chir. Trans.* not yet published. One of the two successful cases was treated by my friend, Mr.

James, of Exeter, the other by Mr. A. C. Hutchinson, who has taken the trouble to collect the history of them.

Attempts have been made to extirpate the enlarged thyroid gland; but, the numerous large arteries distributed to this part, the dilated state of these vessels when the gland is much enlarged, and the vicinity of the carotid arteries, render this operation exceedingly dangerous, especially when the swelling is very large, the only instance, in which a patient would submit to this mode of cure. In doing it, one would be obliged to cut arteries large enough to pour forth a vast quantity of blood in a very short time, and so situated, that it would be difficult to tie, or effectually compress them. Mr. Gooch relates two cases, which do not encourage practitioners to have recourse to the excision of enlarged thyroid glands. In one of these instances, so copious an hemorrhage took place, that the surgeon, though equally bold and experienced, was obliged to stop in the middle of the operation. No means availed in entirely suppressing the bleeding, and the patient in a few days died. In the other example, the same event nearly took place, the patient's life only being saved by compressing the wounded vessels with the hand, day and night for a whole week, by persons who relieved each other in turn. The surgeon found this the only way of stopping the hemorrhage, after many fruitless attempts to tie the vessels.

These cases are well calculated to deter prudent men from undertaking the hazardous operation of cutting out an enlarged thyroid gland, except under the most urgent circumstances. When bronchoceles obstruct respiration, deglutition, and the return of blood from the head, in a very serious degree, an enterprising surgeon would feel greatly inclined to make any rational attempt to relieve his patient, even though it might be one of a bold description. In such pressing circumstances, a good operator, well acquainted with the anatomy of the neck, might attempt the extirpation of the swelling, (See *Thyroid Gland*,) or, as I should prefer, he might tie one or both of the superior thyroid arteries. When the quantity of blood flowing into a tumour, is suddenly, and greatly lessened, the size of the swelling commonly soon undergoes a considerable diminution. This operation was practised by Sir W. Blizard, who tied the arteries of an enlarged thyroid gland, and, in a week, the tumour was reduced one-third in its size. The ligatures then sloughed off; repeated bleeding took place from the arteries, and by the extension of the hospital gangrene, the carotid itself was exposed. The patient died; yet, as Mr. A. Burns maintained, this did not militate against a repetition of the experiment; the same thing might have happened from merely opening a vein, and, in the confined air of an hospital, has actually happened. (*Surgical Anatomy of the Head and Neck*, p. 202.)

In fact, the rationality of the experiment prevented surgeons from being intimidated by the failure in question, and, with that laudable spirit for the improvement of operative surgery, every where diffusing itself through the profession, other gentlemen were soon found who had judgment enough to make further trials of the practice. In a young man, twenty-four years of age, whose breathing was much impeded by a bronchocele, and whose upper thyroid arteries were very large, and affected with strong pulsations, Walther, of Landshut, tied the left of these vessels, the left side of the gland being the largest. The operation was done on the 3d of June, 1814. An incision, an inch and an half in length, was made in the direction of the inner edge of the sterno-cleido-mastoid muscle, where the throbbing of the artery was quite distinct. By a second stroke of the knife, the platysma-myoides was divided in the same direction, and to an equal extent. The vessel was then exposed by a cautious dissection, and separated from the surrounding parts, and one arterial branch, which was divided, was immediately secured. A ligature, composed of three silk threads, was then conveyed with an aneurism needle under the left thyroid artery, and tied with two simple knots. The wound was then closed with adhesive plaster, and the end of the ligatures brought out at the angles. The ligature on the large artery came away on the 12th day; and without any febrile symptoms, or other bad consequences, the wound was perfectly healed on the 23d day. As early as the 3d day, after the application of the ligature, the left part of the tumour began to be less tense, and the throbbing feel in it soon ceased. By degrees, it dwindled away, becoming as it lessened harder, and, as it were, cartilaginous. In a fortnight, the left half of the swelling was one third smaller, than before the operation; and, at length, only one-third of it remained, while the right side also was somewhat smaller. On the 17th of June, Walther took up the right superior thyroideal artery, which was more difficult to get at, as it lay more deeply, and was much concealed under the enlarged gland, which had pushed it out of its natural situation. The operation lasted three-quarters of an hour, and several large and small arteries which were cut were tied. With respect to the thyroid artery itself, it could not be tied without including a part of the gland in the ligature. No unfavourable symptoms followed this second operation; the ligatures were detached in good time: and the wound healed up very well. The right portion of the bronchocele also now diminished; but, though it was originally smaller than the left, it did not dwindle away so completely as the latter. The remains of the tumour, however, two years afterwards, produced no inconvenience, and respiration was quite easy. (See *Neue Heilart des Kropfes*, &c. von Ph. Fr. von Walther, p. 25,

&c. 8vo. Sulzbach, 1817.) On the 29th of December, 1818, Mr. Henry Coates, of Salisbury, took up the superior thyroideale artery for the cure of a bronchocele, which, in a young woman aged seventeen, was pressing on the trachea and œsophagus, and attended with a great noise in breathing. The superior thyroideale arteries were in this instance large, and pulsated strongly. Mr. Coates cut down upon the left of these vessels, separated it from its accompanying nerve, and passed under it a small round ligature, which was drawn moderately tight, and tied. The next day, there was headach, and some swelling of the neck and side of the head, with increased difficulty of swallowing, and febrile symptoms. These complaints, however, were relieved by bleeding and antimonial medicines. The ligature came away on the ninth day, and, on the fourteenth, the wound was completely healed. On the 14th of February, the breathing being much improved, and the tumour reduced nearly to one half of its former size, the patient was well enough to be discharged from the Infirmary. (See *Med. Chir. Trans.* Vol. 10, p. 312.) My friend Mr. Rose lately mentioned to me a case, in which a similar operation done by Mr. Brodie, did not produce any material diminution of the tumour.

Dr. Parry has remarked a frequent coincidence, either as cause or effect, between enlargement of the thyroid gland and cardiac diseases (*Elements of Pathology*, &c. p. 181.) And, another modern writer mentions, that he has lately seen three cases of this complication. (*Medico Chir. Journ.* Vol. 1, p. 181.) A case is detailed by Flajani, where the disease was accompanied with extraordinary palpitations of the heart. (See *Collezione d'Osservazioni*, &c. di *Chirurgia*, T. 3, p. 270.) In the instance, here referred to, there was great irregularity of the pulse, and the oppression of the breathing was such, that the patient was obliged to submit to venesection at least every month, whereby he had been rendered quite emaciated.

Albucasis gave the first good account of bronchocele. See *Turner's Surgery*, Vol. 1, p. 164. *Wilmer's Cases and Remarks in Surgery*, with an Appendix on the Method of Curing the Bronchocele in Coventry, 8vo. Lond. 1779. *Prosser, an Account and Method of Cure of Bronchocele, or Derby-neck*, 8vo. Lond. 1769. Also 3d Edit. 4to. Lond. 1782. *Bell's Surgery*, Vol. 5. *White's Surgery. Memoirs of the Med. Society of London*, 217. *Gooch's Chirurgical Works*, Vol. 2. p. 96.—Vol. 3, p. 157. *Desault's Parisian Chirurgical Journal*, Vol. 2, p. 292. *Œuvres Chirurgicales de Desault*, par Bichat, Tom. 2. p. 298. *V. Malacarne, lettre sur l'Etat de Cretins*, (Frank Del. op. 6) Edinb. Med. and Surgical Journal, Vol. 4, p. 279. *Otier's Manuel de Médecine Pratique*, 8vo. Geneve, 1811. *Dr. Reeves's Paper on Cretinism* in Edinb. Med. and Surg. Journal, Vol. 5, *Traité du Goitre et du Cretinisme*, par F. E. Foderé, 8vo. Paris, an. 8. *Richler's*

Anfangsgrunde der Wundarzneykunst, B. 4. Kap. 13. Von Kropfe. *Surgical Anatomy of the Head and Neck*, by A. Burns, p. 191, &c. *Larrey, Memoires de Chirurgie Militaire*, Tom. 1, p. 123. Tom. 3, p. 199, &c. *J. F. Ackermann, über die Kretinen, eine besondere Menschenart in den Alpen*. 8vo. Gotha, 1790. *B. S. Barton, A Memoir concerning the Disease of Goitre, as it prevails in different parts of North America*, 8vo. Philadelphia, 1800. *Memoria Patologico-Practica sulla Natura de Gozzo*, &c. del Dottor Prospero Postiglione, 12mo. Firenze, 1811. *Kortum Comment, de Vitio Scrophuloso*, T. 2. *Giuseppe Flajani, Collezione d'Osservazioni Riflessi oni di Chirurgia*, T. 3, p. 270, &c. 8vo. Roma, 1802. *Quadri in Med.-Chir. Trans.* Vol. 10, p. 16, *Dict. des Sciences Med. art. Bronchocele*: Ph. Fr. *Walther, Neue Heilart des Kropfes durch die Unterbindung der obern Schilddrüsen-Schlagadern, nebst der Geschichte eines durch die Operation geheilten Aneurismas der Carotis*. 8vo. Sulzbach, 1817. *H. Coates, in Med. Chir. Trans.* Vol. 10, p. 312, &c. *Léveillé's Nouvelle Doctrine Chirurgicale*, T. 4, p. 125, &c. *Lassus, Pathologie Chirurg.* T. 1, p. 408, &c. *Petit, Œuvres Posthumes*, T. 1. p. 255. *Haller, Opuscula Pathologica*, Obs. 5. p. 16. *J. L. Alibert, Nosologie Naturelle*, T. 1, p. 464, &c.; fol. Paris, 1817. For the best plates of the disease, see *Dr. Baillie's Series of Engravings*, &c. Fasc. 2, Tab. 1.

BRONCHOTOMY, (from *βρυγχος*, the windpipe, and *τομή*, to cut.) This is an operation, by which an opening is made into the larynx, or trachea, either for the purpose of making a passage for the air into, and out of, the lungs, when any disease prevents the patient from breathing through the mouth and nostrils; or of extracting foreign bodies, which have accidentally fallen into the trachea; or, lastly, in order to be able to inflate the lungs in cases of sudden suffocation, drowning, &c. The operation is also named *tracheotomy*. Its practicable nature and little danger, are founded on the facility, with which certain wounds of the windpipe, even of the most complicated kind, have been healed, and on the nature of the parts cut, which are not furnished with any vessel of consequence.

When the incision is made in the larynx, the operation is termed *laryngotomy*. With respect to bronchotomy, its performance cannot be regarded as either difficult, or dangerous: *dummodo*, (says Fabricius ab Aquapendente) *qui secat sit anatomes peritus, quia sub hoc medico et artifice, omnia tutissimè et felicissimè peraguntur*.

Bronchotomy is occasionally practised in order to enable the patient to breathe, when respiration through the mouth and nostrils is impeded by disease.

Cynanche laryngea sometimes creates a necessity for the operation, and this is particularly the case, when the disease is situated in the edges of the rima glottidis, which opening becomes so contracted as scarcely to leave the smallest space. For this reason, and on account of the tension of

the ligaments of the glottis, the voice is rendered excessively acute, and hissing as it were. The suffocation is imminent; the lungs not being expanded, the blood accumulates, in these organs, and more or less impediment prevails to the return of the blood from the head. There can be little doubt, that many patients who have perished under these circumstances, might have been saved by a timely incision in the trachea. The majority of writers, who have treated of bronchotomy, as a means of preventing suffocation in inflammatory diseases of the larynx, have regarded this operation as the ultimate resource. Both the Greeks and Arabians were of this sentiment; and Avicenna only recommends bronchotomy in violent cases of cynanche, when medicines fail, and the patient must evidently die from the unrelieved state of the affection. Rhazes also advised the operation only when the patient was threatened with death.—Thus in former times, though practitioners were aware of the principle, on which bronchotomy became necessary, they generally found the operation fail, because it was delayed too long, and rarely done, ere effusion had commenced in the lungs themselves.

It was doubtless in consequence of the ill success of the operation, that Paulus Ægineta observed: *In cynanchicis quidem chirurgiam improbamus, cum inutilis sit precisio.* Bronchotomy, says Louis, will always be done too late, when only practised as an extreme measure. In cases of inflammation about the throat, the danger of perishing by suffocation, as this author remarks, has been known from the very dawn of medicine. The advice of Hippocrates, to remedy this urgent symptom, is a proof of it, and, he observes, that the danger is evinced when the eyes are affected and prominent, as in persons who have been strangled, and when there is great heat about the face, the throat, and neck, without the appearance of any external defect. He recommends *fistula in fauces ad maxillas intrudenda, quâ spiritus in pulmones trahatur.* No doubt, he would have advised more, had it not been for the doctrine of his time, that wounds of cartilages were incurable.

This method, defective as it was, continued till the time of Asclepiades, who, according to Galen, was the first proposer of bronchotomy. Since Asclepiades, this operation has always been recommended, and practised in cases of quinsy, threatening suffocation, notwithstanding the inculcation of Cælius Aurelianus, who treated it as fabulous. The mode of doing it, however, has not been well detailed by any body who put it in practice, except Paulus Ægineta, who is precise and clear. "We must (says he) make the incision in the trachea, under the larynx, about the third or fourth ring. This situation is the most eligible, because it is not covered by any muscle, and no vessels are near it. The patient's head must be kept back, in order that the trachea may project more forward. A transverse cut is to be made between two of the

rings, so as not to wound the cartilage, only the membrane." The knowledge of this method, and its advantages in cases of the *angina strangulans*, when practised in time, ought, according to Louis, to have rendered its performance a general practice.

The convulsive angina of Boerhaave, which particularly affects those, who can only breathe well in an upright posture, has also been adduced as a case demanding the prompt performance of bronchotomy.—Mead, in his *Precepta et Monita Medica*, mentions a case, in which the patient had been bled, very copiously twice in the space of six hours, but he died notwithstanding this large evacuation. The same author took notice in Wales, especially, on the sea-coast, of an epidemic catarrhal quinsy, which carried the patients off in two or three days. In these instances, bleeding was not of much use, and bronchotomy, which was not performed, was the only means by which the patients might have been saved.

In cases of angina and croup, some modern practitioners have been less sanguine in their expectation of benefit from bronchotomy than Louis was. From the observations of Dr. Cheyne, it would appear, that in croup, the operation cannot be necessary for the purpose of admitting air into the trachea; for, in those, who have died of the disease, he has found a pervious canal of two-eighths of an inch in diameter, and through a tube of such diameter, even an adult can support respiration for a considerable time. According to the same writer, bronchotomy is equally unfitted for the removal of the membrane formed by the effusion of lymph; for, from its extent, variable tenacity, and adhesions, this is, in almost every case, totally impracticable; and even could the whole membrane be removed, still the function of respiration would be but little improved, the ramifications of the trachea and bronchial cells remaining obstructed. (See *Cheyne's Pathology of the Larynx and Bronchia.*)

No doubt, Dr. Cheyne's statement of what is found in the dead subject is correct; and yet the operation may be necessary to prevent suffocation, which might otherwise be induced partly by the diminution of the natural passage for the air by disease, and partly by the action of the muscles of the glottis; a circumstance to which Dr. Cheyne has not assigned sufficient importance. On this point, the sentiments of Mr. C. Bell are more correct: speaking of the membrane of croup, formed by the effusion of coagulable lymph, and of the cause of death in these cases, he says, "It has not appeared to me, that it was the violence of the inflammation which destroyed the patient, nor the irritation directly from the inflamed membrane; but that the presence of this secreted membrane, acting like a foreign body, at the same time occasions spasms in the glottis, obstructs the passage, and confines the mucus. But, I am bound to state, in the strongest terms, that death is ultimately a consequence of

effusion in the lungs, occasioned by the continued struggle and difficulty; for, on opening the chest, I have uniformly found, that the lungs did not collapse, and that the bronchiæ were full of mucus. This corresponds with the symptoms; for, before death, the violence of the cough and struggle has given place to coldness and insensibility, with a pale swelling of the face and neck, and when the child has fallen into this state, giving freedom to the trachea will be of no avail." (*Surg. Obs.* p. 16.)

In the cases of croup, which Mr. Chevalier has examined after death, he has found the trachea obstructed with mucus, and he thinks, that it is more, by this secretion, than by that of coagulable lymph, that suffocation is finally produced. At all events, he succeeded in saving a boy on the point of suffocation, by making an incision in the trachea, and letting out an ounce, or an ounce and an half, of reddish, brown, frothy mucus. And a case, of a very similar description, in which the same practice answered, I attended, about two years ago, with Mr. Lawrence, and Dr. Blicke. This case, however, was different from Mr. Chevalier's in the circumstance of a tube being required for a couple of days after the operation, when the removal of the instrument was followed by no inconvenience.

Pelletan joins several modern writers, in representing bronchotomy, as generally useless in cases of croup; the only example, in which he thinks the operation might be serviceable, is where the disease is confined to the larynx, a case which he sets down as uncommon, and difficult to be distinguished. "*En supposant enfin l'angine avec concrétion bien caractérisée, on se trouvera encore entre la crainte de pratiquer une opération inutile, si les concrétions se prolongent jusque dans les bronches, et l'impossibilité de juger si ces concrétions sont bornées au larynx. C'est en effet dans ce seul cas que l'opération peut être fructueuse; elle facilitera la respiration pendant que la nature, aidée de l'art, travaillera à dissoudre, détacher, et faire expectorer les fausses membranes qui oblitérent la glotte et le larynx.*" (*Clinique Chirurgicale.* Tom. 1, p. 28.)

Of course, the degree of success, which will attend the practice of bronchotomy in cases of this nature, must always mainly depend upon the operation being done early enough, and in cases, where the lungs are not too seriously affected; for, if the effects of pneumonia are far advanced, the patient's chance of recovery will be hopeless, whether the trachea be opened or not. In order, also, to have a reasonable chance of success, in cases, threatening suffocation, from inflammation of the parts about the fauces, as sometimes happens, the operation must not be deferred too long. We see this fact exemplified in two cases recorded by Flajani; in one, where the operation had not been allowed till a late period of the disease, the patient died; in the other, where the practice was adopted earlier, life

was preserved. (*Collezione d' Osservazioni, &c.* T. 3, p. 230—233.)

A few years ago, Dr. Baillie published three cases, in which death was produced in the adult subject, and, in a very few days, by a violent inflammation of the larynx and trachea. The disease had a strong resemblance to croup; but, yet was different from it. There was not the same kind of ringing sound of the voice as in croup, and no layer of coagulable lymph was formed upon the surface of the inner membrane of the larynx and trachea, which, according to Dr. Baillie, uniformly attends the latter disease. In one of these cases, the cavity of the glottis was found to be almost obliterated, by the thickening of the inner membrane of the larynx at that part. The inner membrane of the trachea was likewise inflamed; but in a less degree. The lungs were sound. If, in thirty hours, no relief should be derived from bleeding ad deliquium, and the exhibition of opiates, Dr. Baillie conceives, that, in this sort of case, it might be advisable to perform the operation of bronchotomy at the upper part of the trachea, just under the thyroid gland. This operation, he thinks, would probably enable the patient to breathe, till the inflammation in the larynx, more especially, at the aperture of the glottis, had time to subside. (See *Trans. of a Society for the Improvement of Med. and Chir. Knowledge.* Vol. 3, p. 275, 289.)

An acute affection of the membrane of the glottis, proceeding rapidly to a fatal termination by suffocation, has also been lately particularly described by Drs. Farre and Percival. (See *Med. Chir. Trans.* Vols. 3, and 4.) In some bodies, which Mr. Lawrence examined after death, he found appearances analogous to those mentioned by the above physicians. "The patients died of suffocation: but the progress of the complaint was much slower, than in those cases; the symptoms were not acute, nor did the inspection of the parts disclose any evidences of active inflammation. The membrane, covering the chordæ vocales, was thickened, so as to close the glottis, and a similar thickening extended to a small distance from these parts, accompanied with an cedematous effusion into the cellular substance under the membrane. The epiglottis did not partake of the disorder. In one or two instances, this thickened state of the membrane was the only change of structure observed; but in others it was attended either with ulceration of the surface near the glottis, appearing as if it had been formed by an abscess, which had burst; or with a partial death of one or more of the cartilages of the larynx, viz. the arytenoid, thyroid, or cricoid. The rest of the air passages and the lungs were healthy." (*Med. Chir. Trans.* Vol. 6, p. 222.)

In such examples, this gentleman is a zealous advocate for the early performance of bronchotomy, and he has cited several instances, in which this operation was successfully performed, both for the relief of

quinsy and extraction of foreign bodies from the trachea.

The affections of the larynx, requiring bronchotomy, would seem, indeed, to be more numerous and diversified, than is usually supposed: thus, Mr. C. Bell mentions the case of a medical student, who was attacked with shivering, fever, and sore throat, and in three days died of suffocation. On dissection, no obstruction in the larynx was observed, but only an inflammation of its membrane, and a spot like a small pox pustule, upon the margin of the glottis. (*Surgical Obs. Part 1, p. 14.*)

2. The compression of the trachea by foreign bodies lodged in the pharynx, or by tumours, formed outwardly, and of sufficient size to compress the windpipe, is an equal reason for operating, more or less expeditiously, according to the symptoms. Mr. B. Bell mentions two instances of suffocation from bodies falling into the pharynx. Respiration was only stopped for a few minutes; but, the cases were equally fatal, notwithstanding the employment of all the usual means. This author thinks, there was every reason to believe, that bronchotomy would have been attended with the greatest success, if it had been performed in time, before the effects of the suffocation had become mortal. The operation should also be done, when the trachea is compressed by tumours. The author of the article *Bronchotomie*, in *l'Encyclopédie Méthodique*, says, that about twenty years ago, he opened a man, who had died of an emphysema, which came on instantaneously. He had had, for a long while, a bronchocele, which was of an enormous magnitude towards the end of his life. The cavity of the trachea was so obliterated, that there was scarcely room enough to admit the thickness of a small piece of money. Doubtless, bronchotomy, performed before the emphysema made its appearance, would have prolonged this man's days.

In cases of this last description, Desault would have advised the introduction of an elastic gum catheter into the trachea from the nose, in order to facilitate respiration. This practice, I believe, has not hitherto been attempted by English surgeons, though it has been repeatedly tried in France. (See *Œuvres Chir. de Desault, T. 2, p. 236, &c.*)

Habitot successfully performed this operation on a lad fourteen years old, who, having heard, that gold, when swallowed, did no harm, attempted to swallow nine pistoles wrapped up in a piece of cloth, in order to hide them from thieves. The packet, which was very large, could not pass the narrow part of the pharynx; and here it lodged, so that it could neither be extracted, nor forced down into the stomach. The boy was on the point of being suffocated by the pressure, which the foreign body made on the trachea; and his neck and face were so swollen and black, that he could not have been known. Habitot, to whose house the patient was brought, attempted in vain, by different

means, to dislodge the foreign body. At length, perceiving the patient in evident danger of being suffocated, he resolved to perform bronchotomy. This operation was no sooner done, than the swelling and lividity of the face and neck disappeared. Habitot pushed the pieces of gold down into the stomach with a leaden probe, and the pistoles were, at different times, discharged from the anus, eight or ten days afterwards. The wound of the trachea very soon got quite well. (See *Mem. de l'Acad. de Chirurgie, Tom. 12, p. 243, Edit. in 12mo.*)

In such a case, Desault would have introduced an elastic gum catheter into the larynx, instead of performing bronchotomy, which could not answer, were the foreign body low down. (See *Œuvres Chirurg. de Desault, Tom. 2, p. 247.*)

3. Foreign bodies in the trachea, may render it necessary to practice bronchotomy. Here I ought rather to say, perhaps, laryngotomy, which by several modern surgeons is in these cases deemed most applicable. (*Desault; C. Bell, Surg. Obs. Part 1, p. 47, &c.*)

Louis, in an excellent memoir, on extraneous substances in the trachea, has proved, more convincingly than all other preceding writers, the necessity of the operation in circumstances of this kind. The following case fell under his observation.

On Monday, the 19th of March, 1759, a little girl, seven years old, playing with some dried kidney-beans, threw one into her mouth, and thought she had swallowed it. She was immediately attacked with a difficulty of breathing, and a severe convulsive cough. The little girl said she had swallowed a bean, and such assistance as was thought proper, was given her. Want of success was the cause of several surgeons being successively sent for, who vainly employed the different means, prescribed by art, for extracting foreign bodies from the œsophagus, or forcing them into the stomach. A fine sponge, cautiously fastened to the end of a whalebone probang, was repeatedly introduced through the whole extent of the œsophagus. The little girl, who made a sign with her finger, that the foreign body was situated in the middle of the neck, thou, at that she felt some relief, when the sponge was conveyed below the place which she pointed out. She had, every now and then, a violent cough, the efforts attending which produced convulsions in all her limbs. Deglutition was unobstructed; and warm water and oil of sweet almonds had been swallowed without difficulty. Two whole days had been passed in sufferings, when the relations called in Louis. The little girl, with all possible fortitude and sense, was several times held in her friends' arms, ready to die of suffocation. Louis, well aware of what had happened, came into the room where the patient was. She was sitting up in her bed, suffering no other symptom than a very great difficulty of breathing. Louis

inquired where she felt pain, and she made such a sign in reply, as left no doubt concerning the nature of the accident. She put the index finger of her left hand on the trachea, between the larynx and sternum. The fruitless attempts which had been made in the œsophagus, with a view of dislodging the foreign body; the nature and the smallness of this body, which was not such as would be stopped in the passage for the food; and the facility of swallowing, were negative proofs, that the bean was not in the œsophagus. Respiration was the only function disturbed; it was attended with difficulty, and a rattling in the throat. The little girl expectorated a frothy fluid, and she pointed out so accurately the painful point where the object producing all her sufferings was situated, that Louis did not hesitate to declare to the relations, from this single inspection, that the bean was in the windpipe, and that there was only one way of saving the child's life, which was to make an incision, for the purpose of extracting the foreign body. He apprised them, that the operation was neither difficult nor dangerous, that it had succeeded as often as it had been practised, and that the very pressing danger of the case only just allowed time to take the opinion of some other well-informed surgeons, respecting the indispensable necessity for such an operation. Louis thought this precaution necessary, in order to acquire the confidence of the parents, and to shelter himself from all reproach, in case the event of the case should not correspond with his hopes. Louis went home to prepare all the requisites for bronchotomy, and, in two hours, he was informed the surgeons, who were consulted, waited for him. Since Louis went away, the child had become quiet, and was lying on its side asleep. The opinion he had delivered, had been ill-explained by the friends and attendants, and had been discussed, before his return. They, who had been rendering their assistance, on the supposition, that the foreign body was in the œsophagus, evinced surprise at the proposal of extracting, by an operation, a substance, the presence of which, in any part of this tube, was not obvious. Louis explained his advice, in regard to bronchotomy, and he did not expect a doubt to be set up against so positive a fact. The investigation of truth may authorize objections, to which those who make them, only give the value which is due; but Louis was asked concerning the possibility of the case. It was objected, that a substance as large as a bean could not insinuate itself into the trachea. He brought every one into his sentiment, by a short explanation of cases of this sort, with which he himself was acquainted. The little girl was examined; she was better than when Louis saw her before, and a very palpable emphysema was seen above the clavicle, on each side of the neck, a symptom which did not exist two hours previously. This swelling made Louis conclude, that the urgency for the

operation was still greater. The friends, whose confidence had been shaken by the opposition he had experienced in bringing about unanimity, were in the greatest embarrassment, when they were told, that the child might die of an operation, which he had represented as only a simple incision, free from all danger. Louis was repeatedly asked, if he would be responsible for the child's life during the operation, and he in vain replied, that if there were any thing to fear during the operation, it would be from the accident itself, and not from the assistance rendered. This distinction was not perceived, and Louis withdrew, at the same time refusing his consent to the exhibition of two grains of emetic tartar, the effect of which would be useless, and might be dangerous. The medicine was given in the night: the child was fatigued with its operation, and quite unbenefitted. On Tuesday morning, Louis found the little girl very quiet, and they who had paid their visits earlier, found her wonderfully well. The respiration, however, continued to be still attended with a rattling noise, which Louis had observed in the evening, when her breathing was much more laborious. The child was nearly suffocated several times in the course of the day, and died in the evening, three days after the accident.

Bordenave, who had seen the patient, informed Louis of the child's death on Friday. The body was opened, before a numerous assembly of persons. After making a longitudinal incision through the skin and fat, along the trachea, between the sternohyoidei muscles, Bordenave slit open the trachea, cutting three of its cartilages.—This very instant, every one could see the bean, and Louis took it out with a small pair of forceps. It was manifest, from the ease with which this foreign body was extracted, that the operation would have had, on the living subject, the most salutary effect. The relations had to regret having sacrificed a child, which was dear to them, to an irresolution and a timidity, which the most persuasive arguments could not remove. (*Mem. de l'Acad. Royale de Chirurgie, Tom. 12, p. 293, &c. Edit. in 12mo.*)

This case evinces, in the most decided manner, the symptoms which result from the presence of foreign bodies in the trachea, and shows the only one surgical proceeding, which can be of use. But, among the phenomena, apparently difficult of explanation, is the calm, which, at different intervals, followed the afflicting cough.—Anatomy, however, has dispelled much of the doubt on this matter. It is known, that the whole canal of the trachea is much less sensible than the rima glottidis. A foreign body, like a bean, may remain a certain time in that canal without much inconvenience, the passage being only somewhat obstructed, according to the position of the substance. It may even remain several days, months, or years, without producing any symptom of its presence, except a trivial sensation of obstruction, and

this is what happens when the body lodges in one of the ventricles of the larynx.—Facts of this kind are to be found in Tulpus, Bartholine, and many other observers. But, when the extraneous substance quits its situation, and is carried into the trachea, the irritation which it produces there, and, particularly about the larynx, occasions coughing, and if, in the fits, the foreign body should become fixed between the lips of the glottis, it may cause instantaneous death, as probably has happened in many of the cases of suffocation from extraneous substances.

Another remarkable circumstance which deserves more attention, as it confirms the presence of a foreign body in the trachea, is the emphysema, which appeared about the clavicle, towards the termination of the case. Louis did not believe, that any of the persons, who saw the patient, could entertain a just idea of the origin of this symptom. The supposition, that the obstruction, which the foreign body caused for two days, to the free passage of the air, might have occasioned a forcible distention of the trachea, and a rupture of the membrane, which connects together the cartilaginous rings of this tube, was dispelled by the examination after death. The windy tumour had not originated in the circumference of the trachea: here its limits were only seen. The very substance of the lungs, and the mediastinum, were emphysematous. The air, confined by the foreign body, had ruptured the air-cells, during the violent fits of coughing, and thus insinuated itself into the interlobular cellular substance of the lungs. Thence it had passed into the cellular substance of the lungs; and afterwards into that connecting the pleural pulmonalis with the outer surface of these organs; and by the communication of the cells with each other, it had produced a prodigious swelling of the cellular substance, between the two layers of the mediastinum. The emphysema, in its progress, at length made its appearance above the clavicles. The swelling of the lungs, and circumjacent parts, in consequence of the insinuation of air into the cellular substance, is a manifest cause of suffocation. The tumefaction appears to be so natural an effect of the presence of a foreign body in the trachea, that one can hardly believe it is not an essential symptom, though, before Louis, no author has made mention of it.

Foreign bodies in the trachea, however, do not always cause death so suddenly, which may be owing to their smallness, their smoothness, or the situation in which they are fixed. An example is related in *les Ephémérides des Curieux de la Nature*, Decad. 2. Ann. 10. As a monk was swallowing a cherry precipitately, the stone of the fruit passed into the trachea. A violent cough, and excessive efforts, as it were, to vomit, were the first symptoms of the accident, and of these the patient thought he should have died. A sleep of

some hours followed this terrible agitation, and the patient afterwards did not feel the least inconvenience during a whole year. At the end of this time he was attacked by a cough, attended with fever. These symptoms became worse and worse, every day. At length the patient evacuated a stone as large as a nutmeg. It was externally composed of tartareous matter, to which the cherry stone had served as a nucleus. A copious purulent expectoration followed the discharge of the foreign body, and the patient died consumptive some time afterwards. No mention is made of the body being opened; but, from the symptoms, there is every reason to believe, that an abscess must have arisen in the substance of the lungs, from the presence of the foreign body. That foreign bodies in the trachea, even when they do not induce pressing symptoms of suffocation, may ultimately kill the patient by inducing disease of the lungs, is proved by several cases on record, and, particularly by one, which occurred to Desault; a cherry-stone was lodged in one of the ventricles of the larynx; the patient would not consent to an operation, and died after two years *d'une phthisie laryngée*. (See *Œuvres chir. de Desault*, P. 2, p. 258.)

Some valuable observations, confirming the necessity of an early recourse to bronchotomy, in cases where foreign bodies are lodged in the trachea, have been published by Pelletan, now one of the surgeons of the Hôtel Dieu, and a practitioner of vast experience. In one case, in which a bean had fallen into a child's trachea, and in which the most urgent symptoms of suffocation had prevailed for four days, and convulsions during the last thirty-six hours of this space of time, M. Pelletan performed the operation, which a timid practitioner, under whose management the young patient was first placed, had neglected to do at an earlier period. Upon the incision being made into the trachea, the bean was immediately thrown out to the distance of two feet, and the child for a time was relieved. The little boy was so extremely weak, that it was at one time supposed he was dead. However, with some assistance, he gradually revived, even regained his senses, called his parents, and asked for such things as he wanted.

This hopeful state lasted eight or ten hours, after which, convulsions came on again, and the child died fourteen hours after the operation.

Notwithstanding the turgid appearance of all the blood vessels of the brain, as detected after death, the little boy had yet received a degree of relief at the instant of the foreign body being extracted. Pelletan deems it unnecessary to insist on the great probability of success that would have attended the operation, had it been performed at an earlier period.

Of such success, Pelletan gives us the following example.

In May, 1798, a child about three

years old, was brought to the Hôtel Dieu, who, in playing with some French beans, and putting them into its mouth, let one of them slip into the trachea. For three days the child was afflicted with a continual cough, and sometimes the symptoms of suffocation were most pressing. This time had been spent in administering emetics, introducing instruments into the œsophagus with the design of forcing the foreign body into the stomach, and in inspiring the relations with a pernicious confidence, arising from the very long intervals of repose, which the child experienced, during which, however, a rattling in the throat continued, a characteristic mark of the accident. Pelletan immediately decided to perform the operation. The child was very fat, and this circumstance, together with the small diameter of the trachea at this age, rendered the exposure of the anterior portion of this tube difficult. Pelletan was at this moment struck with the reflection, that bronchotomy should never be attempted except by men of science, coolness, and experience in operations. The rings of the trachea, however, were at length cut, and there was no sensible interval, between the incision and the expulsion of the foreign body. The bean had swelled considerably with the moisture. The child seemed restored to life; it spoke freely; it was only troubled with coughing, the effect of a small quantity of blood insinuating itself into the trachea, which fluid was instantly rejected again. This event has the appearance of convulsions, and may alarm those, who do not understand it; but according to Pelletan, it is the guarantee of the patient's life by expelling, incessantly, and without difficulty, whatever happens to get into the trachea. The wound was healed in twenty days, and the child's voice was not perceptibly altered.

In another interesting case, recorded by the same writer, a pebble was lodged in the windpipe, and the case, not being understood, was treated, for about three weeks, as a simple inflammation of the lungs. At last, bronchotomy was performed, and, by placing the child in a horizontal position, the stone was soon discharged through the incision. The patient was immediately relieved; but, the effects of the inflammation of the lungs, and injury which these organs had sustained, could never be entirely cured, and the child died phthisical eight months afterwards.

Pelletan details other cases, in which the foreign body, being fixed in the trachea, could not be forced out by the breath, as soon as the incision was made, but, required further means to disengage it. In one instance, Pelletan made a long cut in the windpipe of a child; but, nothing made its appearance. A probe, wrapped round with some oiled linen, was then introduced several times up and down the larynx, without creating a great deal of uneasiness, and the child continued to respire very well through the opening in the trachea. The foreign

substance was presently brought to the wound and extracted: it proved to be part of the jaw of a mackarel, with many sharp teeth in it. This child soon experienced a perfect recovery.

In another instance, a young man came to the Hôtel Dieu, in consequence of being afflicted, for six weeks, with a severe cough, frequently accompanied with a sense of suffocation. These complaints, on inquiry, were ascertained to arise from a button-mould having fallen into the trachea. An opening was, therefore, made in this tube; but, though the button could be felt, it could not be extracted with the finger. The cricoid cartilage was now divided, and the foreign body was then taken out of the left ventricle of the larynx. The man recovered.

In one case, related by Pelletan, a piece of tendon of veal got down the glottis, and gave rise to most dangerous symptoms. The foreign body was described as being so large, that this surgeon could not but suppose, that the complaints were owing to its lodgment in the œsophagus, as it seemed to be incapable of entering the glottis. The introduction of instruments down the pharynx, however, produced no relief; but, on dividing the thyroid cartilage, Pelletan passed his finger within the larynx, and, without knowing it, pushed the piece of tendon towards the glottis, when, with the aid of a probang, it was forced into the pharynx and swallowed. The patient experienced immediate relief, and got quite well. (See *Pelletan's Clinique Chir. T. 1.*)

With respect to bronchotomy, or laryngotomy, for cases in which extraneous substances are supposed to be lodged in the trachea, one important caution seems necessary, viz. whenever the foreign body is above a certain size, a probang should always be passed down the œsophagus before cutting into the windpipe; for, very similar symptoms to those, which proceed from extraneous substances in the trachea, may be caused by the lodgment of foreign bodies in the œsophagus. In fact, bronchotomy has actually been performed, while the extraneous substance was in the œsophagus, from which last situation no attempt was made to displace it, and the patient lost his life. (See *Œuvres Chir. de Desault, T. 2, p. 261.*) Examples, in which various extraneous bodies have been successfully extracted by means of bronchotomy, are recorded by Engel. (*Sendschreiben an Schmid, &c. Augsp. 1750; Guncourt, Journ. de Méd. Vol. 12, p. 44; Heister, Wahrnehmungen, 1, p. 1026; Wendt. Hist. Trachelomix, &c. Uratist. 1774.*)

4. Bronchotomy has been proposed in cases, in which the tongue is so enlarged, as totally to shut up the passage through the fauces. Richter mentions an inflammation of the tongue, in which this part became four times larger than in the natural state. Valescus had made the same observation: *Ego aliquando vidi ita magnificatam linguam propter humores, ad ejus su-*

stantiam venientes, et ipsam indubitanter, quod quasi totum os replebat, et aliquando ex ore exibat. Lib. 2, cap. 66. Such prodigious swellings of the tongue are said sometimes to occur in malignant fevers and the small-pox. They are also sometimes quite accidental, as, for instance, the cases which happen from the stings of insects, or the unskilful employment of mercury. Mr. B. Bell gives an example of the latter sort.—He says, that the patient had taken, in a very short time, so large a quantity of mercury, that the part became alarmingly swollen in a few hours, and, though all the usual remedies were tried, none had the least effect. Bronchotomy was delayed till the patient was nearly suffocated; but he was restored as soon as an opening was made in the trachea. Some have objected to this practice, alleging, that scarifying the tongue will bring relief in time: (*Encyclopédie Méthodique; Partie Chirurgicale, Art. Bronchotomie.*) Malle's observations on the swelling of the tongue, and the most effectual means of relieving it, seem to confirm the latter sentiment. (*Mém. de l'Acad. de Chirurgie, Tom. 14, p. 408, &c. Edit. in 12mo.*)

In cases of the preceding description, Desault would have advised the introduction of an elastic gum catheter, from the nose into the trachea, in order to enable the patient to breathe, until the swelling of the tongue had subsided. (See *Œuvres Chir. de Desault. T. 2, p. 246.*)

5. Bronchotomy has been proposed, when both the tonsils are so enlarged that they quite impede respiration. Here, the inflammatory swelling is not meant; this commonly soon suppurates, and the spontaneous bursting of the tumour, or the opening of it with a pharyngotomus, generally removes all necessity for so extreme a measure. But, even in acute inflammation and great enlargement of the palate, tonsils, &c. attended with imminent danger of suffocation, the practice has been sometimes deemed necessary, as the cases, cited from Flajani, in the preceding columns, are sufficient to prove. The disease, however, which I here wish particularly to specify, as sometimes rendering bronchotomy indispensable, is a chronic enlargement of the tonsils, the case mentioned in the article *Tonsils*. From the remarks on the disease, however, it will be seen, that more is to be expected from the excision of the tonsils, than from the operation now in question. Besides, before the glands are so large as to threaten suffocation, they should be cut away, in preference to performing bronchotomy, which might relieve the urgency, but could not be the cause of the difficulty of breathing.—In general, there is no urgent danger of suffocation, till the swelling is such as not only to shut up the posterior aperture of the mouth, but also the posterior openings of the nostrils, which is exceedingly rare. In cases of obstructed respiration from enlargement of the tonsils, Desault preferred the introduction of the elastic catheter,

from the nose into the larynx, to the operation of bronchotomy. It is not common for a polypus to make this operation necessary. Boerhaave, however, mentions a case, in which the patient was suffocated, as the surgeon was going to extirpate a tumour of this kind: no doubt, this patient might have been saved, if bronchotomy had been previously performed. Polyypi, growing in the larynx itself, are very rare; but examples are recorded, and, if such tumours happen to obstruct the glottis, the patients are instantly suffocated. Some instances of this kind are related by Bichat. The only mode of getting at such swellings, so as to extirpate them, is by performing bronchotomy. (See *Œuvres Chir. de Desault, T. 2, p. 254, 255.*)

6. Lastly, bronchotomy has been recommended to be done on persons recently suffocated or drowned. Detharding is the first author, who has treated of the necessity of this operation, in the latter case, in a letter addressed to Schroeck, entitled, *De Methodo subveniendi submersis per laryngotomiam*. Hactenus recte, says Haller, *si spuma quæ pulmo in submersis offertur ea administratione repelli quiret*. This writer maintains, that drowned persons have no water in their chests, or air-vessels of the lungs, and that they perish suffocated, for want of air and respiration, and that, while the person is under water, the epiglottis applies itself so closely over the glottis, that not one drop of water can pass. But, these assertions are quite contrary to the numerous experiments made by Louis, who drowned animals in coloured fluids, and proved that they who are drowned, inspire water, with which the air vessels and cells are quite filled. Louis has also opened men, who have perished under water, but, in them, he never found the epiglottis applied to the glottis, as Detharding says it is; indeed, anatomy proves the impossibility of its being so. Detharding's theories were wrong, and, as he did not use any power to distend the lungs with air, his mere practice of bronchotomy must have been useless.—When there is a free communication between the cells of the lungs and the atmosphere, the air will not expand these organs, if the inspiratory muscles can no longer act. Hence, after opening the trachea, and letting as much water run out of this tube as possible, the pipe of a pair of bellows should be introduced, and the air forcibly introduced into the lungs.

Detharding was right in his opinion, that drowning is a species of suffocation, and that the privation of oxygen gas is the cause of death. Hence, the propriety of introducing this air into the lungs, as speedily as possible, whenever animation has not been so long suspended, that every hope of restoration is over. Indeed, it is proper to distend the lungs with air, in all cases in which animation has been recently suspended by suffocation, immersion under water, or by noxious vapours and gases.—This measure is highly proper, in conjunc-

tion with electricity, the communication of warmth to the body, the application of strong volatiles to the nostrils, rubbing the body with warm flannels, and the injection of any fluid, like warm wine and water, into the stomach, through a hollow bougie. However, tobacco clysters, which have had the sanction of the Royal Humane Society, should be reprobated, as the qualities of this plant are peculiarly destructive of the vital principle, and not simply stimulating. I am sorry to find this last means commended by so respectable a surgeon as Baron Larrey, who joins the rest of the French surgeons in condemning electricity and bronchotomy. He speaks in favour of opening the jugular vein, exposing the body to the fire, friction, &c. On dissecting the bodies of some drowned persons, Larrey found, as Louis had done long since, that the air tubes of the lungs were filled with water, instead of air, and that the epiglottis was raised and applied to the os hyoides. (See *Mémoires de Chir. Militaire*, T. 1, p. 83-85.)

There are many modern practitioners, who consider bronchotomy, as needless in cases of suspended animation, because it is contended, that, as the patient is always destitute of sensation, a tube may easily be passed into the trachea from the nose or mouth, for the purpose of inflating the lungs. Either the curved pipe of a pair of bellows may be introduced into the glottis through the mouth, or an elastic gum catheter may be passed into the trachea from the nose.—

"On peut mettre ce moyen à exécution (says Pelletan) chez les asphixiés, ou les enfans, nouveaux nés, qui ne respirent pas; parce, dans ces différens cas, non seulement il n'y a pas d'inflammation, mais même toute sensibilité est suspendue, et la canule est commode pour souffler de l'air dans les poulmons, en même temps qu'elle peut causer une irritation salutaire. M. Baudeloque, mon célèbre confrère, m'a témoigné se servir habituellement, et avec succès de ce moyen pour appeler à la vie les nouveaux nés dont la respiration ne s'établit pas." (*Clinique Chirurgicale*, Tom. 1, p. 29.) Desault likewise conceived, that the lungs might be easily inflated, without performing bronchotomy. (*Œuvres Chir.* Tom. 2, p. 239.) Mr. A. Burns adopts the same sentiment. (*Surgical Anatomy of the Head and Neck*, p. 384.) My own individual opinion upon this subject is, that, if a surgeon knows, that he can inflate the lungs as completely and expeditiously, without performing bronchotomy, as he could by making an incision in the trachea, he is right in dispensing with the latter operation. But, in the generality of cases of suspended animation, (that of new-born infants excepted, where bronchotomy would be an objectionable undertaking,) I much doubt, whether in actual practice bronchotomy will not be found the best and most speedy means of enabling the surgeon to distend the lungs with air. If you follow Desault's suggestion, I contend, that you are likely to be some minutes longer in

getting the elastic catheter from the right nostril into the larynx, than you would be in cutting into the trachea, and introducing into the incision the muzzle of a pair of bellows. Supposing the elastic catheter introduced, will you now be able to distend the lungs with air, in an adequate degree, an object of the highest moment? A pair of bellows seems to me almost essential to this purpose. I shall say nothing on the probability of many practitioners coming to the patient unprovided with the requisite sort of tube.

If a pair of bellows, with a curved pipe, be employed, many surgeons would be a considerable time in getting the muzzle into the glottis, and, in the meanwhile every spark of life might be extinguished. On the other hand, bronchotomy (performed by a man of ordinary care and skill) is an operation free from danger. It may be executed with a penknife, if no better instrument be at hand; and when the incision has been made, a pair of common bellows will suffice for the inflation of the lungs. Did I conceive, that bronchotomy were a perilous operation; that the lungs could be effectually distended without the employment of bellows; that the object could generally be accomplished as expeditiously without cutting into the trachea; I should be as ready to join in the condemnation of this last proceeding, as any contemporary writer. Greatly, however, as I respect most of the authors, who differ from me on this point, the reasons I have assigned, prevent me from subscribing to their sentiment. Desault, who may be regarded as the founder of the doctrine, concerning the inutility of bronchotomy, it is also to be observed, spoke only from theory, and not actual practice, in these cases.

With respect to the performance of the operation, no preparation is necessary, as delay only increases the danger. The patient being seated in an arm-chair, or, what is better, laid on a bed with his head hanging backward, an incision is to be made, which is to begin below the cricoid cartilage, and to be continued downward, about two inches, along the space between the sternothyroidei muscles. Care should be taken not to cut the lobes of the thyroid gland, lest a troublesome and dangerous bleeding be occasioned, and, as the left subclavian vein lies a little below the upper part of the first bone of the sternum, the incision should never extend so low as this point. The knife must not be carried either to the right or left, in order to avoid all risk of injuring the large blood-vessels situated at the sides of the trachea. The incision in the integuments having been made, the sternothyroidei muscles are to be pushed a little towards the side of the neck, so as to bring the trachea fairly into view. Most authors recommend the point of the knife to be then introduced between the third and fourth cartilage of the trachea, and the opening to be enlarged transversely. It is true, that, in this way, an opening may be safely

made large enough to allow a small cannula to be introduced. It is safer, however, in all cases, to enlarge the opening in the perpendicular direction, by cutting from within outward. There is no advantage in avoiding a wound of the cartilages of the trachea, the only reason assigned for cutting the membrane between them, in a transverse direction; while a sufficiently large opening cannot be thus safely obtained, in cases in which it is necessary to introduce the muzzle of a pair of bellows, in order to inflate the lungs. In short, it is safer and better, in every instance, to make the wound in the trachea in a perpendicular manner.

I have stated, that bronchotomy may be performed by a man of ordinary skill, without hazard. It is far otherwise with a careless practitioner. Weread in Desault's work, that in one instance, the carotid artery was wounded. The following cautions, given by Mr. A. Burns, seem entitled to notice. "The arteria innominata is in risk in some subjects. I have seen it mounting so high on the forepart of the trachea, as to reach the lower border of the thyroid gland. Even the right carotid artery is not always safe. I am in possession of a cast, taken from a boy of twelve years of age, which shows the right carotid artery crossing the trachea in an oblique direction. In this subject, that vessel did not reach the lateral part of the trachea till it had ascended two inches and a quarter above the top of the sternum.

"Where both carotid arteries originate from the arteria innominata, there is considerable danger in performing the operation of tracheotomy, for in such cases, the left carotid crosses the trachea pretty high in the neck. Professor Scarpa has seen a specimen of this distribution in a male subject, and I have met with five.

"These varieties in the course of the arteries are worthy of being known, and remembered; they will teach the operator to be on his guard, since he can never, *a priori*, ascertain the arrangement of the vessels with any degree of certainty. It will impress on his mind the impropriety of using the knife further, than merely to divide the integuments and fasciæ. If he then clear the trachea with the fingers, he will never injure any of the large arteries. When, with the finger, he has fairly brought the trachea into view, he ought to examine carefully, whether any of the large arteries lie in front of it, and if he find one, he ought to depress it toward the chest, before he penetrates into the windpipe.

"In cutting into the trachea, the preferable plan is to cut the rings from below upward, avoiding injury of the thyroid gland." (See *A. Burns on the Surgical Anatomy of the Head and Neck*, p. 393, 394.)

When bronchotomy is performed for the purpose of inflating the lungs, the cut in the windpipe must be made somewhat larger, than when an opening is required merely to enable the patient to breathe through a

small cannula. The larger size of the pipe of the bellows, is the reason of this circumstance.

When a cannula is introduced, care must be taken not to pass it too far into the wound, lest it should injure the opposite side of the trachea. This is a caution, on which Fabricius ab Aquapendente dwells very strongly, and with good reason.

Small as the vessels may be, which are divided in bronchotomy, they occasionally bleed so much, as to create apprehension, and even prevent the continuance of the operation. There is a case in Van Swieten's Commentaries, confirming this remark. A Spanish soldier, aged twenty-three, was in the most urgent danger from an inflammation of his throat. It was thought nothing could save him, except bronchotomy. After the longitudinal cut in the skin, and the separation of the muscles, the trachea was opened between two of the cartilages; but the blood insinuated itself into this canal, and excited so violent a cough, that the cannula could not be kept in by any means, though it was replaced several times. Louis remarks, that in this instance, the patient's head should have been turned downward, in order to keep the blood from flowing backward into the trachea. It is asserted, that the opening of this tube was not always opposite the external wound, in consequence of the convulsive action of the muscles, and that the patient on this account could hardly breathe. Hence, Vigili was induced to slit open the trachea, down to the sixth cartilaginous ring; and it was only then that he inclined the patient's head forward. The bleeding now ceased, the patient breathed with ease, and, on the second day, the inflammation was so much better, that respiration went on without the aid of the opening in the trachea.

In order to obviate the preceding accident, a proposal has been made to adapt a cutting blade to a cannula, of a suitable size, calculated for remaining in the wound, and sufficiently compressing the orifices of such vessels as may be opened. In Richter's *Observationes Chirurgicæ*, a description of some instruments of this kind may be seen. Mr. B. Bell has described one, somewhat like a flattened trocar, only not quite so long. The patient's head being inclined backward, as far as possible, the point of the instrument is to be introduced between two of the cartilages: between the lower margin of the thyroid, and the upper edge of the cricoid, is said to be the best situation, being more extensive, less vascular, and, after the division of the skin, only the crico-thyroid ligament requires to be divided. When the instrument has entered, the lancet is to be withdrawn, and the cannula fixed, by means of a ribbon, which is tied to each of the wings of the instrument, and must be fastened at the back of the patient's neck. Should the instrument be too long, it must be passed through two or three little compresses, before being put into the wind-

pipe, which artifice will make it answer as well as if it were shorter. A piece of gauze is then to be tied over the orifice of the cannula.

A more simple and natural mode, however, of obviating all trouble from the entrance of blood into the trachea, is to tie any bleeding branch of the thyroid artery, or vein, before the windpipe is opened.

Sometimes, though very seldom, the cannula becomes obstructed with mucus, or clots of blood. Such an accident nearly suffocated a patient at Edinburgh. An ingenious person happening to be at hand, suggested the introduction of a second cannula into the first; the second one being taken out, and cleaned, as often as necessary, and then replaced.

The use of the cannula must be continued as long as the causes obstructing respiration remain. Thus, in one very interesting case of cynanche, detailed in a modern publication, the patient, thirteen months after the operation, had not been able to discontinue the tube. (See *Med. Chir. Journ. Vol. 5, p. 7.*) This example was attended in its progress with a singular circumstance, viz: the expulsion through the cannula of several portions of calcareous matter, or bone.

When respiration is suspended by the presence of a foreign body in the trachea, and the extraneous substance does not make its appearance at the opening, a trial may be made to discover its situation by means of a bent probe. When it lies downward, which it hardly ever does, the wound in the trachea may be enlarged in this direction, and the body extracted with a pair of curved forceps. The extraneous substance is mostly forced out by the air, as soon as the incision in the trachea is opened. When it cannot be immediately found, some practitioners (Heister and Raw,) have succeeded by keeping the lips of the wound asunder with a leaden cannula, by which means, the force of the air in expiration has, in a few hours, expelled the foreign body.

Richter gave the preference to a curved cannula; and since his time many surgeons have chosen to use such an instrument, though if it be double, the inner tube cannot be so easily introduced as that of a straight cannula, and, no doubt the chief disadvantage of the latter has often proceeded from its having been made of too great length.

In some instances, like that referred to above, a cannula has been borne quietly in the trachea, while in others, it has produced so much irritation, cough, and sense of choking, as to render its immediate removal necessary. Mr. Lawrence, in speaking of the obstruction of the glottis from the disease already adverted to in this article, observes, that when the cannula causes inconvenience, he should advise a longitudinal incision, of about half an inch, in the middle of the trachea, and the removal of a

thin slip of the tube, which would leave an artificial opening for respiration equal in size to the natural one. (See *Med. Chir. Trans. Vol. 6, p. 249.*)

On the continent, the operation of laryngotomy, which was first advised, by Vicq d' Azyr, and was recommended by Desault, is frequently preferred to tracheotomy. The surgeon makes an incision over the anterior part of the thyroid cartilage, punctures the crico-thyroid membrane, and, if it be necessary, introduces a director, and slits the thyroid cartilage upwards. A single opening in the crico-thyroid membrane, would suffice for the introduction of a cannula for the purpose of enabling the patient to breathe; but for the extraction of foreign bodies, it would be necessary also to cut the thyroid cartilage. The fact, that extraneous substances, when they are loose, are almost always lodged at the upper part of the larynx, proves, that laryngotomy, in such cases, must commonly be most advantageous; and, according to Desault, even when the foreign bodies are lower down in the trachea, they may in general be most easily extracted with the aid of a pair of curved forceps. In this country, laryngotomy has been less commonly practised, though commended a few years since, by Mr. Coleman, and more recently by Mr. C. Bell.

"Of the three situations (says Mr. Lawrence,) in which it has been proposed to make the opening, viz. in the thyroid cartilage, between that and the cricoid, or in the trachea, I consider the first as the least eligible. Besides the objections from the ossification of the cartilage, and the danger of wounding, or otherwise injuring, the chordæ vocales, there is the inconvenience in the case of angina laryngea, arising from the swollen and thickened state of the membrane, which may actually impede the passage of the air. I am not aware of any objection to a transverse opening between the thyroid and cricoid cartilages. The prominence of the former in the neck, serves as a guide to the part, which should be opened. Whether bronchotomy, or laryngotomy ought to be selected, must of course depend upon the nature of the case: in cases of cynanche, the proximity of the inflamed parts would be an objection to laryngotomy; while in examples of foreign bodies within the glottis, this operation may generally be most advisable, for reasons already explained. It is absurd to think of confining one mode of operating to different cases. (See *Medico-Chir. Trans. Vol. 6, p. 248.*)

Of the operation, performed in the membranous space, Mr. C. Bell entertains a favourable opinion. He directs us to slit up the membrane, and open the incision with the handle of the knife, when the patient will immediately breathe with ease. Here, says he, there is nothing to alarm the most timid operator. No great turgid veins are opened; the cut is made above the thyroid

gland; and above the anastomosing branch of the thyroid arteries. The part is strongly marked by the prominence of the thyroid cartilage above, and the ring of the cricoid cartilage below. "If the occasion be temporary, a simple slit of the membrane will be found sufficient. If necessary, a transverse cut will afford any degree of opening. If a round hole be desired, the four corners, left by the incisions, may be snipped off," or the edges of the opening may be kept asunder by means of the doubled wire of a catheter, the middle part of which lies on the wound, while the ends are bent round the neck, and tied by a ligature behind. In Mr. C. Bell's cases, less annoyance was caused by this contrivance, than by a tube.

The reader may collect the most valuable information on the foregoing subject from the following sources; *Hevin sur les corps Etrangers qui sont arrêtés dans les premières Voies, et qu'il faut tirer par incision, in Mém. de l'Acad. Royale de Chirurgie, Tom. 3, p. 131, &c. edit. 12mo. Louis, Mémoire sur une question Anatomique relative à la jurisprudence, où l'on établit les principes pour distinguer, à l'inspection d'un corps trouvé perdu, les signes du suicide d'avec ceux de l'assassinat. Van Swieten's Commentaries. Habcot, Question Chirurgicale, par laquelle il est démontré que le Chirurgien doit assurément pratiquer l'opération de la Bronchotomie, &c. 12mo. Paris, 1620. Mémoire sur la Bronchotomie par M. Louis, in Mém. de l'Acad. de Chirurgie. Tom. 12, Edit. 12mo. Second Mémoire on this subject, inserted by the same writer in the said volume. De la recision des Amygdales, Tom. 14, p. 283, &c. Précis d'Observations sur le Gonflement de la Langue, &c. par M. de la Malle, Tom. 14, p. 408. Lescure, sur un portion d'Amande de noyau d'Abricot, dans la Trachée Artère, Tom. 14, p. 427. Suite d'Observations sur les Corps Etrangers dans la Trachée Artère, Tom. 14, p. 432. Expériences sur ces Cas par M. Favier, Tom. 14, p. 445. Bertrandi, Traité des Operations de Chirurgie, p. 402, &c. Edit. 1784. Sabatier, de la Médecine Opératoire, Tom. 2, p. 283, Edit. 1. Œuvres Chir. de Desault par Bichat, T. 2, p. 236, &c. Pelletan, Clinique Chirurgicale, T. 1. first Memoir. Cheyne, Pathology of the Larynx and Bronchia, Edinb. 1809. A. Burns, Surgical Anatomy of the Head and Neck, p. 377 to 401. J. F. Double Traité du Croup, 8vo. Paris, 1811. Richter's Anfangsgrunde der Wundarzneikunst, Band 4, p. 225, &c., Göttingen 1800. Lawrence on some affections of the larynx, which require the operation of bronchotomy, in Medico-Chirurgical Trans. Vol. 6, p. 221, &c. Baillie in Trans. of a Society for the Improvement of Med. and Chir. Knowledge, Vol. 3. Troussel-Drelincourt Corps étrangers, arrêtés dans les Voies aériennes, Nouveau Journ. de Med. par Becclard, &c. T. 7. p. 101. Philos. Trans. 1730, No. 416, Art. 5. Journal de Médecine, T. 38, p. 158. J. A. Albers Comm. de Trachitide Infantum, vulgo Croup vocata, 4to. Lips. 1816. Case of Chronic infl. of the Larynx,*

in which laryngotomy was performed; See Med. Chir. Journ. Apr. 1820. F. J. Baur-lant de Bronchotomia Diss. in Coll. Diss. Lovan. 2, 175. G. Delharding Epist. Med. de Methodo subveniendi submersis per laryngotomiam, Rostochii, 1714. Flajani Osservazioni, &c. di Chirurgia, T. 3. Roma, 1802. R. Collard, Abhandlung über den Croup, 8vo. Hannov. 1814. T. Chevalier's Case of Croup, in Med. Chir. Trans. Vol. 6, p. 151, &c. Andree's Case, in Vol. 3, same work, p. 335, with the Obs. of Dr. Farre on Cynanche in the same part of the Work; and those of Dr. Percival on the same subject, in Vol. 4, p. 297. C. W. Eberhard, De Musculis Bronchialibus in Statu et Morbosa Actione, 8vo. Marburg. 1817. R. Sprengel, Geschichte der Chirurgie. Th. 1. p. 177, 8vo. Halle, 1805. Dict. des Sciences Med. Art. Bronchiotomie, T. 3, 1812. Surgical Observations, by G. Bell, Part 1, p. 14, &c. 8vo. Lond. 1816. Case of Cynanche Laryngea, requiring Tracheotomy, and the continued use of a Cannula, ever since the Operation, in Med. Chir. Journ. Vol. 5, p. 1. 8vo. Lond. 1818.

BUBO. (*Bubæ*, the groin.) Modern surgeons mean, by this term, a swelling of the lymphatic glands, particularly of those in the groin, and axilla.

The disease may arise from the mere irritation of a local disorder; from the absorption of some irritating matter, such as the venereal poison; or from constitutional causes.

Of the first kind of bubo, that, which is named the *sympathetic*, is an instance. Of the second, the venereal bubo is a remarkable specimen. (See Venereal Disease.)

The *pestilential bubo*, which is a symptom of the plague, and *scrofulous swellings* of the inguinal and axillary glands; may be regarded as examples of buboes from constitutional causes. (See Scrofula.)

The inguinal glands often become affected with simple phlegmonous inflammation, in consequence of irritation in parts, from which the absorbent vessels, passing to such glands, proceed. These swellings ought to be carefully discriminated from others, which arise from the absorption of venereal matter. The first cases are simple inflammations, and only demand the application of leeches, the cold saturnine lotion, and the exhibition of a few saline purges; but the latter diseases render the administration of mercury indispensable. *Sympathetic* is the epithet usually given to inflammation of glands from mere irritation; and, we shall adopt it, without entering into the question of its propriety.

The sympathetic bubo is mostly occasioned by the irritation of a virulent gonorrhœa. The pain, which such a swelling gives, is trifling, compared with that of a true venereal bubo, arising from the absorption of matter, and it seldom suppurates. However, it has been contended, that the glands in the groin do sometimes swell and inflame from the actual absorption of venereal matter from the urethra, in cases of gonorrhœa, and which swellings must con-

sequently be venereal. (*Hunter on the Venereal, p. 57.*)

The manner, in which buboes form from mere irritation, will be better understood by referring to the occasional consequences of venesection, in the article *Bleeding*.

The distinguishing characters of the venereal bubo are noticed in the article *Venereal Disease*.

BUBONOCLE. (from *βυβων*, the groin, and *κλην*, a tumour.) A species of hernia, in which the bowels protrude at the abdominal ring. The case is often called an *inguinal hernia*, because the tumour takes place in the groin. (See *Hernia*.)

BURNS are usually divided into three kinds. 1st. Into such as produce an inflammation of the cutaneous texture, but an inflammation, which, if it be not improperly treated, almost always manifests a tendency to resolution. 2dly. Into burns, which injure the vital powers of the cutis, occasion the separation of the cuticle, and produce supuration on the surface of the cutaneous texture. 3dly. Into burns, in which the vitality and organization of a greater or less portion of the cutis are either immediately or subsequently destroyed, and a soft slough or hard eschar produced. (See *Thomson's Lectures on Inflammation, p. 585, 586.*)

Suppuration is not always an unavoidable consequence of the vesications in burns; but it is a common and a troublesome one. "In severe cases, it may take place by the second, or third day; often not till a later period. It often occurs without any appearance of ulceration; continues for a longer, or shorter time; and is at last stopped by the formation of a new cuticle. In other instances, small ulcerations appear on the surface or edges of the burn. These spreading form extensive sores, which are in general long in healing, even where the granulations, which form upon them, have a healthy appearance." (*Op. cit. p. 595.*)

Burns present different appearances, according to the degree of violence, with which the causes producing them have operated, and according to the kind of cause, of which they are the effect. Burns, which only irritate the surface of the skin, are essentially different from those, which destroy it; and these latter have a very different aspect from what others present, which have attacked parts more deeply situated, such as the muscles, tendons, ligaments, &c. Scalds, which are the effect of heated fluids, do not exactly resemble burns, occasioned by the direct contact of very hot metallic bodies, or some combustible substance on fire. As fluids are not capable of acquiring so high a temperature, as many solid things, scalds are generally less violent than burns, in the injury which they produce; but, in consequence of liquids often flowing about with great rapidity, and being suddenly thrown in large quantities over the patient, scalds are frequently dangerous on account of their extent. It is well worthy of remark, that the

danger of the effects of fire is not less proportioned to the size, than the degree and depth of the injury. A burn, that is so violent, as to kill parts at once, may not be in the least dangerous, if not extensive; while, a scald, which perhaps only raises the cuticle, may prove fatal, if very large. The degree of danger, however, is to be rated from a consideration both of the size and violence of the injury. The worst burns, which occur in practice, arise from explosions of gunpowder, or inflammable gases, from ladies's dresses catching fire, and from the boiling over of hot fluids, in laboratories, manufactories, &c.

Burns, which only destroy the cuticle, and irritate the skin, are very similar to the effects, produced by cantharides and rubefacients. The irritation, which such injuries excite, increases the action of the arteries of the part affected, and they effuse a fluid under the cuticle, which becomes elevated and detached. Hence, the skin becomes covered with vesicles, or bladders, which are more or less numerous, and large, according to the manner, in which the cause has operated. But, when the skin, or subjacent parts, are destroyed, no vesicles make their appearance. In this circumstance, a black eschar is seen; and when the dead parts are detached, there remains a sore, more or less deep, according to the depth, to which the destructive effects of the fire have extended.

The parts may either be killed, at the moment of the injury, by the immediate effect of the fire, or they may first inflame, and then mortify.

In all cases of burns, the quantity of injury depends on the degree of heat in the burning substance; on the duration and extent of its application; and on the sensibility of the burnt part.

When a large surface is burnt, mortification sometimes makes its appearance with great violence, and very quickly after the accident; but, in general, the symptom, the most to be dreaded, in such cases, is inflammation. The pain and irritation often run to such a pitch, that, notwithstanding every means, there is frequently immense trouble in keeping down the inflammation. When the burnt surface is very large, the effects of the inflammation are not confined to the part, which was first injured; but, even cause a great deal of fever; and, in certain cases, a comatose state, which may end in death.

It has been observed, that persons, who die of severe burns, seem to experience a remarkable difficulty of breathing, and oppression of the lungs. These organs, and the skin, are both concerned in separating a large quantity of water from the circulation, and their participating in this function may, perhaps, afford a reason for respiration being often much affected, when a large surface of skin is burnt. However, the kidneys perform the same office, and they are not particularly affected in burnt patients; so that the asthmatic symptoms, frequently

noticed in cases of burns, are probably owing to a sympathy between the lungs and skin, or else to causes not at present understood.

TREATMENT OF BURNS.

Two general methods of treating burns have at all times been followed. One consists in the application of substances, which produce a cooling or refrigerant effect; the other in the employment of calefacient or stimulating substances. Dr. Thomson is satisfied, that each of these different modes may have its advantages in particular cases. (*Lect. on Inflammation, p. 588.*)

The practice mostly resorted to in this country some years since, is explained by Mr. B. Bell. When the skin is not destroyed, but seems to suffer merely from irritation, relief may be obtained by dipping the part affected in very cold water, and keeping it for some time immersed. This author states, that plunging the injured part suddenly into boiling water would also procure ease; an assertion, however, much to be doubted, and a practice not likely to be imitated. In some cases, emollients afford immediate relief; but, in general, astringent applications are best. Strong brandy or alcohol is particularly praised. At first the pain is increased by this remedy; but an agreeable soothing sensation soon follows. The parts should be immersed in the spirit, and, when this cannot be done, soft old linen, soaked in the application, should be kept constantly on the burn.—The liquor plumbi superacetatis dilutus is recommended. It is said to prove useful, however, only by being astringent, as equal benefit may be derived from a strong solution of alum, &c. Such applications were frequently made with the view of preventing the formation of vesicles; but, Mr. B. Bell always remarked, that there was less pain, when the blisters had already appeared, than when prevented from rising, by remedies applied immediately after the occurrence of the injury.

The applications should be continued as long as the pain remains; and in extensive burns, creating great irritation, opium should be prescribed. The stupor, with which patients, so situated, are often attacked, receives more relief from opium, than any thing else.

Some recommend opening the vesications immediately; others assert, that they should not be meddled with. Mr. B. Bell thinks they should not be opened till the pain arising from the burn is entirely gone. At this period, he says, they should always be punctured; for, when the serum is allowed to rest long upon the skin beneath, it has a bad effect, and even induces some degree of ulceration. Small punctures, not large incisions, should be made. All the fluid having been discharged, a liniment of wax and oil, with a small proportion of the superacetate of lead, is to be applied.

On the subject of opening the vesications

in burns, Dr. Thomson believes, that the diversity of opinion arises from the different effects resulting from the particular manner in which the opening is made. "If a portion of the cuticle be removed, so as to permit the air to come into contact with the inflamed surface of the cutis, pain, and a considerable degree of general irritation, will necessarily be induced; but if the vesications be opened cautiously with the point of a needle, so as to allow the serum to drain off slowly, without, at the same time, allowing the air to enter between the cuticle and cutis, the early opening of the vesications will not only not occasion pain, but will give considerable relief, by diminishing the state of tension, with which the vesications are almost always, in a greater or less degree, accompanied. When opened in this manner, the vesications often fill again with serum; but the punctures may be repeated as often as is necessary, without any hazard of aggravating the inflammation. Great care should be taken, in every instance, to preserve the raised portion of cuticle as entire as possible," &c. (*See Lectures on Inflammation, p. 595.*)

When there is much irritation and fever, blood-letting, and such remedies, as the particular symptoms demand, must be advised. On account of the pulse being frequently small, quick, and vibratory, bleeding is at present not often employed. As Dr. Thomson remarks, however, it may become necessary in patients of a strong robust constitution, in whom the symptomatic fever assumes an inflammatory type.—He has often seen a single bleeding procure great relief in these cases; and he does not remember a case where bleeding was followed by injurious effects. (*P. 594.*) When the skin ulcerates, the treatment does not differ from what will be described in speaking of *Ulcers*.

When burns are produced by gunpowder, or less destroyed, cooling emollient applications were formerly thought most effectual, and a liniment, composed of equal proportions of lime-water and linseed oil, gained the greatest celebrity. Even at this day, the application is very often employed. Mr. B. Bell advises it to be put on the parts, by means of a soft hair pencil; as the application and removal of the softest covering, are often productive of much pain. The same author admits, however, that there are some cases in which Goulard's cerate, and a weak solution of the superacetate of lead, more quickly procure ease, than the above liniment.

The sloughs having come away, the sores are to be dressed according to common principles. (*See Ulcers.*)

When burns are produced by gunpowder, some of the grains may be forced into the skin: these should be picked out with the point of a needle, and an emollient poultice applied, which will dissolve and bring away any particles of gunpowder yet remaining.

Burnt parts, which are contiguous, frequently grow together in the progress of the cure. The fingers, toes, sides of the nostrils, and the eye-lids are particularly liable to this occurrence which is to be prevented by keeping dressings always interposed between the parts likely to become adherent, until they are perfectly healed.

The sores, resulting from burns, are, perhaps, more disposed, than any other ulcers, to form large granulations, which rise considerably above the level of the surrounding skin. No poultices should now be used. The sores should be dressed with any moderately stimulating, astringent ointment: the ung. lapid. calaminaris, or the unguentum resinae with the pulv. hydrarg. nitrat. rub. is now generally preferred: and, if the part will allow of the application of a roller, the pressure of this will be of immense service in keeping down the granulations, and rendering them more healthy. When these methods fail, the sores should be gently rubbed with the argentum nitratum.

In the dry and hot state of the skin, Dr. Thomson is an advocate for diaphoretics. "Laxatives (says he) are often necessary; but, it is in general best to employ only the gentler sort, on account of the trouble and pain, which moving always gives the patient. Anodynes are often required, not only to procure sleep, but even a temporary alleviation of the pungency of the pain, which the burn occasions. A mild vegetable and farinaceous diet should be used during the period of the symptomatic fever. Animal food, wine, and other cordials, may be required in the progress of a suppurating burn; but they are not necessary at first, and when given in this stage, are almost always injurious. (See *Lectures on Inflammation*, p. 594.)

With respect to the topical applications recommended by this gentleman, he generally prefers in cases of superficial burns cooling and refrigerant remedies. When there are vesications, and suppuration takes place without ulceration, he advises us, after refrigerants have ceased to produce beneficial effects, to use the linimentum aquae calcis. However, where the progress of cicatrization is slow, he recommends, instead of this liniment, ointments containing lead, or zinc, particularly the unguentum lapid. calaminaris.

In the ulcerating state of suppurating burns, he prefers emollient cataplasms.—But, when the discharge continues, or becomes more profuse under the use of poultices, they are to be left off, and astringent washes employed, such as lime-water, the compound decoction of oak bark; a weak solution of sulphate of copper, &c.

Where the parts are destroyed and converted into sloughs, Dr. Thomson does not think it matters much whether vinegar, oily liniments, turpentine, spirits of wine, or emollient poultices, be at first employed. He acknowledges, however, that the poultice is the remedy, under the applica-

tion of which, the separation of the dead parts is most easily and agreeably accomplished. "The question (says he) at present most deserving the attention of medical practitioners, with regard to the use of the warm emollient poultice in burns, is, whether we should apply it immediately after the burn has been received, or interpose for some hours, as has been so strongly recommended, dressings with vinegar, spirits of wine, or oil of turpentine. My own experience has not been sufficient to enable me to determine this point to my entire satisfaction. Yet, I think it right to state to you, that, in a number of trials made at different times, I have had occasion to see burns, to which common emollient poultices had been from the first applied, slough and granulate faster, and in a more kindly manner, than similar burns in the same persons, to which in some instances the Carron oil (lin. aq. calcis.) and, in others again oil of turpentine, were applied at the same time with the poultices." (See *Lectures on Inflammation*, p. 609.)

MR. CLEGHORN'S PLAN.

This gentleman, who was a brewer at Edinburgh, was induced to pay great attention to the effects of various modes of treating burns, on account of the frequency of these accidents among his own workmen. His observations led him to prefer the immediate application of vinegar, which was to be continued for some hours, by any of the most convenient means, until the pain abated; and when this returned, the vinegar was repeated. If the burn had been so severe as to have produced a destruction of parts, these, as soon as the pain had ceased, were covered with a poultice, the application of which was continued about six, or, at most, eight hours, and after its removal the parts were entirely covered with very finely powdered chalk, so as to take away every appearance of moisture on the surface of the sore. This being done, the whole burnt surface was again covered with the poultice. The same mode was pursued every night and morning, until the cure was complete. If the use of poultices relaxed the ulcers too much, a plaster, or ointment, containing sub-carbonate of lead, was applied; but the chalk was still sprinkled upon the sore.

With respect to general remedies, Mr. Cleghorn allowed his patients to eat boiled, or roasted fowl, or in short, any plainly dressed meat, which they liked. He did not object to their taking moderate quantities of wine, spirits and water, ale, or porter. He never had occasion to order bark, or any internal medicines whatever, and he only once thought it necessary to let blood. When the patient was costive, Mr. Cleghorn ordered boiled pot-barley and prunes, or some other laxative nourishing food, and sometimes an injection, but never any purgative, as he remarked that the disturbance of frequently going to stool was

distressing to a patient with bad sores. Besides, he thought that a hurtful weakness and languor were always (more or less) brought on by purgatives. From the effects, too, which he felt them have upon himself, and observed them to have upon others, they did not seem to have so much tendency to remove heat and feverish symptoms as is generally supposed, and he believed, that they more frequently carried off *useful* humours than *hurtful* ones.

Diluted sulphuric acid was not found to answer so well as vinegar, and the latter produced most benefit, when it was fresh and lively to the taste.

In cold weather, Mr. Cleghorn sometimes warmed the vinegar a little, placed the patients near the fire, gave them something warm internally, and kept them, in every respect, in a comfortable situation. His object, in so doing, was to prevent the occurrence of tremblings, and chilliness, which, in two instances, after employing cold vinegar, took place in an alarming degree.

The account of Mr. Cleghorn's plan was published by Mr. Hunter. (See *Med. Facts and Observations*, Vol. 2.)

SIR JAMES EARLE'S PLAN.

This gentleman was an advocate for the use of cold water, or rather ice; and published several cases of extensive burns, in which this method was employed with the best effect. Cold water was enumerated by Mr. B. Bell, among the applications to burns, and it was not uncommonly used long before Sir James Earle communicated the result of his experience to the public. The method, indeed, is very ancient.—“Cold is a remedy (says Dr. J. Thomson) which has long been employed to diminish the inflammation of superficial burns.—Rhazes directs, that, in recent burns, cloths dipt in cold water, or in rose-water cooled with snow, be applied as soon as possible to the parts which have been injured, and that these cloths be renewed from time to time; and Avicenna says, that this practice often prevents the formation of blisters.” (*Lectures on Inflammation*, p. 589.) Sir James Earle's publication, however, had the good effect of drawing considerable attention to the subject, and of leading surgeons to try the method in a great number of instances, in which other more hurtful modes of treatment might otherwise have been employed.—The burnt parts may either be plunged in cold water, or they may be covered with linen dipped in the same, and renewed as often as it acquires warmth from the part. The application should be continued as long as the heat and pain remain, which they will often do for a great many hours. (See *Essay on the Means of lessening the Effects of Fire on the Human Body*. Svo. Lond. 1803.)

Some caution, however, in the application of cold becomes necessary, when a scald is of very large size, or situated upon

the trunk of the body. In extensive burns, superficial as they may be, the patient is liable to be affected with cold shiverings; and these shiverings may be greatly aggravated by exposure, and by the application of cold. Perhaps, therefore, in these examples, warm applications ought to be preferred. (*Dr. J. Thomson's Lectures on Inflammation*, p. 591.)

BARON LARREY'S PLAN.

It seems to me, that, on the subject of burns, there is, even at the present day as much contrariety of sentiment, as in any part of surgery whatsoever. After all the praises, which we have of late years heard of vinegar, cold applications, oil of turpentine, &c. a French surgeon, whose talents and opportunities of observation, entitle his opinion to the highest attention, has recently censured the employment of all such remedies. Larrey, though a military surgeon, has had occasion to see numerous burns, in consequence of explosions. He declares, that he has been long struck with the bad effects of repellents, such as fresh water with the muriate of ammonia, oxyerate, the aqua vegeto-mineralis, and the solution of opium in ice-water, applications, which are extolled in some modern books, and used in cases of deep burns, by a great number of practitioners; and he expresses his belief, that such injuries frequently prove mortal, for want of more judicious treatment. He recommends dressing all deep burns, with fine old linen, spread with saffron ointment, which, he says, has the quality of diminishing the pain, and preventing irritation by keeping the nervous papillæ from coming into contact with the air, or being pressed by the linen and clothes. The employment of this ointment, (or in case good oil cannot be procured for its composition, honey, instead of it) is to be continued till suppuration takes place. When this is established, Larrey employs the ointment of styrax, for the purpose of supporting the systaltic power of the subjacent vessels, promoting the detachment of the eschars, and checking the extension of the sloughing. As soon as the dead parts have separated, Larrey again has recourse to the saffron ointment, for which he gradually substitutes dry lint, with strips of linen spread with cerate.—When the vessels exceed the level of the edge of the sore, he touches them with the argentum nitratum, and he occasionally applies a weak solution of the oxy-muriate of mercury, or of the sulphate of copper.

Larrey prescribes emollient and antispasmodic beverages, which are to be taken warm, such as milk of almonds, containing nitre, and properly sweetened; hydromel; rice ptisan, &c. His patients were never deprived of light nourishment, such as broths, jellies, eggs, soups, &c. His experience had taught him, that soldiers (who is to be observed were his patients) bear low diet, so well as persons

inactive life. Besides, he remarks, that as these injuries, with loss of substance, are a long time in healing, it would be acting contrary to the precept of Hippocrates to put burnt patients on low diet. Larrey assures us, that he has found this simple treatment, which he calls soothing and gently tonic, almost always successful. (See *Mémoires de Chirurgie Militaire*, Tom. 1, p. 93.)

DR. KENTISH'S PLAN.

From what has been stated, it appears, that in cases of burns, cold and hot, irritating and soothing, astringent and emollient applications, have all been outwardly employed without much discrimination. But, the internal treatment has always been of one kind, and both the ancients and moderns agree in advising blood-letting, cooling purges, and, in short, the whole of the antiphlogistic plan. If we except Mr. Cleg-horn, who condemned purges, and allowed stimulants internally, Dr. Kentish has been almost the only advocate for the latter means.

The fanciful theories advanced by Dr. Kentish, lead him to believe, that as burns are injuries, attended with increased action, there are two indications, for restoring what he terms *the unity of action*; viz. the excitement, or action, of the part, is first to be gradually diminished; secondly, the action of the system is to be increased to meet the increased action of the part, holding this law as the system in view: *That any part of the system, having its action increased to a very high degree, must continue to be excited, though in a less degree, either by the stimulus, which caused the increased action, or some other having the nearest similarity to it, until by degrees the extraordinary action subsides into the healthy action of the part.*

With this view, holding the part to the fire seems to Dr. Kentish, the best mode of relief; but, as parts of the body are injured, to which this cannot be done, the most stimulant applications must be used; for, in this class, there is little fear of any of them being greater, than that which originally caused the accident. The strongest rectified spirits, made still stronger by essential oils, are proper, and may also be heated as much as the sound parts can bear.—These, and many more applications, of the same class, says Dr. Kentish, will give the most speedy and effectual relief. These are to be continued only for a certain time, lest they cause the very ill which they are given to cure. They are then to be succeeded by less stimulant applications, until the parts act by common natural stimuli.

The internal mode of relief is to give those substances, which soonest excite the system to great action, such as æther, ardent spirits, opium, wine, &c. by which means, the solution of continuity of action is allowed to last the shortest time possible, and the unity of action is restored, which constitutes the cure.

Suppose, for instance, as a local application, we at first apply the strongest alco-

hol, heated to the degree which the sound part would bear without injury: it should afterwards be gradually diluted until it becomes proof spirit, and the heat should be diminished, although gradually, as cold is always pernicious, bringing on that tendency to shiver, which should ever be continually guarded against, as being a most hurtful symptom, and the forerunner of a violent sympathetic fever. To prevent this, the external heat should be kept at a high temperature, and the action of the whole system raised in as great a degree as may be safe. By this means, the action of the whole is made to meet the increased action of the part, by which the lessening of the increased action of the part to join the action of the whole, is rendered more easy. Thus, there is, says Dr. Kentish, an unity of intention by both the external and internal means, leading to the restoration of the unity of action, and the cure is performed.

It may be said, these circumstances can only take place when there is an increased action, and, when the parts are destroyed, other means should be used, such as emollients, &c. In replying to this remark, Dr. Kentish distinguishes burns into two kinds; one, in which the action of the part is only increased; and, another, in which some parts have increased action, while other parts are destroyed. It is of little consequence, says Dr. Kentish, what is applied to the dead part, as the detachment of an eschar depends upon the action of parts, which remain alive, and not upon what is applied to those which are dead. Dr. Kentish remarks, however, that he never saw an instance of a burn, in which, though some parts were totally destroyed, there were not always other parts, in which there was only increased action. Now as our duty is always to save living parts, our mode of cure in the first instance, will always be the same, viz. to cure the parts which have only an increased action, in the doing of which the dead parts will not be the worse, as their separation is a process of the system, which requires time, and, if the injury is to any extent, draws forth the joint efforts of the system, and even, says Dr. Kentish, calls up all the energy of its powers, to violent fever. This state should be supported by every artificial aid, in order to bring the parts to suppuration, otherwise the subject falls in the contest: for, if the living parts have not the power to throw off the dead, the dead will assimilate the living to themselves, and a mortification ensue.

When the living parts have been preserved, (continues Dr. Kentish) which according to this treatment, will be in the course of two or three days, the dead parts will be more plainly observed, and the beginning of the process to throw them off will be commencing. This process must be assisted by keeping up the powers of the system, by stimulant medicines and a generous diet. The separation of the eschars will be greatly promoted by the application of

the stimulus of heat, by means of cataplasms frequently renewed. These may be made of milk and bread, and some camphorated spirit, or any essential oils, sprinkled upon the surface. Such means need only be continued, until the suppuration is established, as then a different mode must be pursued.

After Dr. Kentish had supported this system to a suppuration, he then found that, gradually desisting from his stimulant plan, diminished the secretion of pus, and wonderfully quickened the healing process.

Thus we see, observes Dr. Kentish, the whole of the former treatment inverted.—The most gentle soothing means were used externally and internally; these were continued until suppuration took place; and then the system was excited under an idea of supporting it, which not unfrequently so fatigued the constitution, as to induce a hectic fever. The present mode is the reverse of this. When a part of the frame has been much excited this part is not allowed to cease to act for want of stimulus, but, is kept in action by an adequate stimulus, which is gradually diminished, until the ordinary action returns. With the same view, the internal means are highly stimulant to the whole system, which must be supposed to be in a natural state at the time of the accident.

Thus increasing the action of the whole by strong stimuli, and decreasing the action of the part, by lessening the stimuli, the desired end will be more readily obtained: that is, an equilibrium of action will be restored.

When some parts are destroyed, there must be others with increased action; and, in this case, according to Dr. Kentish, the foregoing mode will be the best for restoring the living parts, and promoting the separation of the dead ones. Suppuration having taken place, the exciting of the system by any thing stimulant, either by food or medicine, should be cautiously avoided.—Should the secretion of pus continue too great, gentle laxatives, and a spare diet, are indicated. If any part, as the eyes, for instance, remain weak, with a tendency to inflammation, topical bleedings, or small quantities of blood taken from the arm, are useful. For the purpose of defending the new skin, camphorated oil, or camphorated oil and lime water in equal parts, are good applications.—Wounds of this kind heal very fast, when the diminution of pus is prevented, by attention to diet: if necessary to keep up the patients' strength, small doses of bark, taken two or three times a day, in some milk, will answer that purpose, and will not excite a quickening circulation, as wine, ale, or spirits, are apt to do. By attention to these principles, (continues Dr. Kentish) I can truly assert, that I have cured very many extensive and dangerous burns and scalds, in one, two, three, and four weeks, which in the former method would have taken as many months; and some, which I believe to have been incurable by the former method.

After explaining his principles, Dr. Kentish takes notice of the several substances,

which have commonly been employed.—Of these he would chiefly rely on alcohol, liquor ammoniæ subcarbonatis, æther, (so applied as to avoid the cooling process of evaporation) and spirit of turpentine.

In applying these, we are directed to proceed as follows: the injured parts are to be bathed, two, or three times over, with spirits of wine, spirits of wine with camphor, or spirit of turpentine, heated by standing in hot water. After this, a liniment, composed of the common yellow basilicon, softened with spirit of turpentine, is to be spread on soft cloth, and applied. This liniment is to be renewed only once in twenty-four hours, and, at the second dressing, the parts are to be washed with proof spirit, or laudanum, made warm.—When a secretion of pus takes place, milder applications must be made, till the cure is effected.

The yellow ointment stops the pores of the cloth, impedes evaporation, and thus confines the effect of the alcohol to the burnt surface. The first dressings are to remain on four and twenty hours. Dr. Kentish thinks it of importance, that the injured surface should be left uncovered as little as possible. It is, therefore, recommended, to have plasters, ready spread, before removing the old ones, and then only to take off one piece at a time.

It will seldom be necessary to repeat the application of alcohol a second time, or that of oleum terebinthinæ. The inflammatory action will be found diminished, and according to Dr. Kentish's principles, the exciting means should therefore be diminished. Warm proof-spirits, or laudanum, may be substituted for the alcohol, and the unguentum resinæ flavæ is to be mixed with oleum camph. instead of turpentine. If this should be found too irritating, Dr. Kentish recommends ung. saturn. or cer. lap. calaminaris. Powdered chalk is to be used to repress the growth of exuberant granulations, and to absorb the pus. In the cavities of separated eschars, and in the furrows, between sloughs and living parts, he introduces powdered chalk. Then a plaster is applied, and, in tedious cases, a poultice over the plaster.

With respect to the internal treatment, the author observes, that great derangement of the system arises in certain persons, from causes, which, in others, produce no effect; and that this depends on a difference in the degree of strength. Hence he concludes, that as strength resists the sympathetic irritative actions of parts, and weakness induces them, we should, in all cases, make the system as strong as we can, immediately upon the receipt of the injury. In considerable burns, he supposes a disproportion of action to take place, between the injured parts, and the system at large, or what he styles, a solution of the continuity of action; and that by a law of the system, a considerable commotion arises, for the purpose of restoring the equilibrium, or enabling the constitution to take on the action of the part. Hence, Dr. Kentish is of opinion, that the indication is to restore

the unity of action of the whole system, as soon as possible, by throwing it into such a state as to absorb the diseased action, and then gradually bring down the whole to the natural standard of action by nicely diminishing the exciting powers. Ether and alcohol, or other stimulants, are to be immediately given in proportion to the degree of injury; and repeated, once or twice, within the first twelve hours, and afterwards, wine or ale is to be ordered, till suppuration takes place, when it will be no longer necessary to excite the system.

In a second essay, Dr. Kentish remarks, that, in the first species of burns, in which the action of the part is only increased, he has not found any thing better for the first application, than the heated oleum terebinthinæ and the basilicon ointment, thinned with the same. In superficial burns, when the pain has ceased, he considers it advisable to desist from this application in about four and twenty hours, and use at the second dressing, a digestive, sufficiently thinned with common oil, beginning on the third day, with the ceratum lap. calaminaris. This author has frequently seen secondary inflammation excited by the remedy. The most certain remedy, for this unpleasant symptom, is a digestive ointment, thinned with oil, or a plaster of cerate, and over that a large warm poultice. The cerate will finish the cure. Should there be much uneasiness of the system, an anodyne, proportioned to the age of the patient, should be given.

The growth of fungus, and the profuse discharge of matter, are to be repressed, as already mentioned, by sprinkling powdered chalk on the surface, and by the use of purgatives, in the latter stages. The chalk must be very finely levigated.

Dr. Kentish's theories are, as far as I can judge, visionary; they may amuse the fancy, but can never improve the judgment. They are nearly unintelligible; they are unsupported by any sort of rational evidence; and, as being only the dreams of a credulous, sportive imagination, they must soon decline into neglect, if not oblivion. However, in making these remarks, it is far from my intention to extend the same animadversion to the mode of treatment insisted upon by Dr. Kentish, which forms a question which cannot be determined by reason, but by experience. He is a man, who has had superior opportunities of observing this part of practice, and the alleged success of his plan of treatment has acquired extensive approbation, although there are still many practitioners, who prefer common methods, and the antiphlogistic principles. The cicatrix of a burn is often of great extent, and, on this account, the subsequent absorption of the granulations on which the new skin is formed, (a process by which the magnitude of the scar is afterwards lessened,) is so considerable as to draw the neighbouring parts out of their natural position, and occasion the most unpleasant kinds of deformity. Thus, burns

on the neck are apt to cause a distortion of the head, or even draw down the chin to the breast bone; and in the limbs such contractions as fix the joints in one immovable position. Simply dividing these contractions again mostly fails altogether, or only produces very partial and temporary relief, as after the cicatrization is completed, the new-formed parts are absorbed, and the contraction recurs. A proposal has been lately made by my friend Mr. Earle, to cut away the whole of the cicatrix, and then bring the edges of the skin as much towards each other as possible, in the transverse direction, with strips of adhesive plaster. In one case, in which "from the forepart of the upper arm, to within about two inches of the wrist, a firm tense cicatrix, of an almost horny consistence, extended, which kept the elbow immovably bent to a right angle," this gentleman performed such an operation. After removing the cicatrix, the flexor muscles at first made some resistance to the extension of the limb; but by degrees they yielded, and the arm was brought nearly to a right line. The whole limb was kept in this position by means of a splint and bandage. In the end, the contraction was cured, and the use of the limb restored. (See *Med. Chir. Trans.* Vol. 5, p. 96, &c.)

Probably, as this patient was a young growing subject, only six years of age, the operation would have proved equally successful, if a simple division of the contracted skin had been made, and the arm kept extended for a length of time by the use of a splint. It is hardly necessary to observe, that cutting a large cicatrix entirely away, must always be a severe, and sometimes a dangerous operation: therefore, the avoidance of it, if possible, cannot but be desirable. (See *B. Bell's System of Surgery; Medical Facts and Observations*, Vol. 2; *J. Sedillot. de Ambustione Theses*, 4to. Parisiis, 1781. *Richter's Anfangsgrunde der Wundarzneykunst*, Band. 1. *Earle's Essay on the Means of lessening the Effects of Fire on the Human Body*, 8vo. Lond. 1799. *Kentish's Two Essays on Burns*, the first of which was published in 1798. *Hedin, Diss. sistens Observationes circa vulnera ex combustione*, &c. 4to. Upsalia, 1804. *Larrey, Mémoires de Chirurgie Militaire*, Tom. 1, p. 3—96. *Boyer's Traité des Maladies Chir.* T. 1, p. 160. *Nodes Dickinson, Remarks on Burns and Scalds*, chiefly in reference to the principle of treatment at the time of their infliction, suggested by a perusal of the last edition of an *Essay on Burns*, by E. Kentish, M D. 8vo. Lond. 1818. *Lectures on Inflammation*, by John Thomson, p. 585, &c. Edin. 1813. *Lassus Pathologie Chir.* T. 2, p. 391. *Léveillé, Nouvelle Doctrine Chir.* T. 4, p. 355. *Pearson's Principles of Surgery*, p. 171. *Edit.* 1808.)

BURSÆ MUCOSÆ.—These are small membranous sacs, situated about the joints, particularly the large ones of the upper and lower extremities. For the most part, they lie under tendons. The celebrated Dr A. Monro, of Edinburgh, published a very full

account of the *bursæ mucosæ*, and also of their diseases. These parts are naturally filled with an oily kind of fluid, the use of which is to lubricate surfaces, upon which the tendons play, in their passage over joints. In the healthy state, this fluid is so small in quantity, that it cannot be seen without opening the membrane containing it; but, occasionally, such an accumulation takes place, that very considerable swellings are the consequence. Tumours of this sort are often produced by bruises and sprains, and, now and then, by rheumatic affections. These swellings are not often attended with much pain, though, in some cases, it is very acute, when pressure is made with the fingers. The tumours yield, in a certain degree, to pressure; but, they rise again, with an appearance of elasticity, not remarked in other sorts of swellings. At first, they appear to be circumscribed, and confined to a small extent of the joint; but, sometimes, the fluid, forming them, is so abundant, that they extend over a great part of the circumference of the limb. The skin, unless inflamed, retains its usual colour.

In this morbid state of the *bursæ mucosæ*, they contain different kinds of fluids, according to the cause of the disease. When the tumour depends on a rheumatic affection, the contents are ordinarily very fluid. They are thicker, when the cause is of a scrophulous nature. When the disease is the consequence of a bruise, or sprain, the effused fluid often contains hard concretions, and, as it were, cartilaginous ones, which are sometimes quite loose, and, more or less, numerous. Such substances may frequently be felt, when the tumour is examined with the fingers.

In practice, such distinctions are not of much consequence. While the swellings are not very painful, an attempt may be

made to disperse them, by warm applications, friction, (particularly with camphorated mercurial ointment,) or blisters, kept open with the *savin cerate*. But, if these tumours should become very painful, and not yield to the above methods, Dr. Monro recommends opening them; a practice, however, which can seldom be really necessary, or proper. This author was continually alarmed at the idea of the bad effects of air admitted into cavities of the body, and, hence, in the operation, even of opening the *bursæ mucosæ*, he is very particular in directing the incision in the skin, not to be made immediately opposite that made in the sac. Care must also be taken to avoid cutting the tendons, near the swelling.

Dr. Monro had seen cases, in which amputation became indispensable, in consequence of the terrible symptoms following the opening of *bursæ mucosæ*.

On account of such evil consequences, which are imputed to the air, though they would as often arise, were the same practice pursued in a situation, in which no air could have access at all, it has been recommended to pass a seton through the swelling, and to remove the silk, after it has remained just long enough to excite inflammation of the cyst, when an attempt is to be made to unite the opposite sides of the cavity by pressure.

I have never seen any swelling of this kind, which could not be discussed by the means usually employed for promoting the absorption of other tumours. Indeed, the treatment should be very like that of *Hydrops articuli*. (See *Joints*.)

Consult *Monro's Description of all the Bursæ Mucosæ*, &c. with remarks on their accidents and diseases, &c. fol. Edin. 1788. C. M. Koch, de *Morbis Bursarum tendinum mucosarum*.

C.

CÆSAREAN OPERATION. Called also *Hysterotomia*, from *ὤστρον*, uterus, and *τομή*, sectio. Pliny, book 7, chap. 9, of his Natural History, gives us the etymology of this operation. *Auspiciatilis* (says he) *enectâ parente gignuntur, sicut Scipio Africanus prior natus, primusque Cæsar à cæso matris utero dictus; quâ de causâ cæsones appellati. Simili modo natus est Manlius qui Carthaginem cum exercitu intravit.*

From this passage we are to infer, that the Cæsarean operation is extremely ancient, though no description of it is to be found in the works of Hippocrates, Celsus, Paulus Ægineta, or Albucasis. The earliest account of it in any medical work, is that in the *Chirurgia Guidonis de Cauliaco*, published about the middle of the fourteenth century. Here, however, the practice is

only spoken of, as proper after the death of the mother, and is alleged to have been adopted only at such a conjuncture in the case of Julius Cæsar. (See *Cap. de Extractione Fetus*.) Vigo, who was born towards the close of the fifteenth century, takes no notice of the Cæsarean Operation; and Paré, who greatly improved the practice of midwifery, thinks this measure only allowable on women, who die undelivered. (*De Hominis Generatione*, cap. 31.) Rousset, who was contemporary with Paré, collected the histories of several cases, in which the operation is said to have been successfully performed, and after the publication of these, the subject excited more general interest.

By the *Cæsarean Operation*, is commonly understood that, in which the fetus is taken out of the uterus, by making an in-

cision into the abdomen, and through the parietes of the womb. The term, however, in its most comprehensive sense, is applied to three different proceedings. It is sometimes employed to denote the incision, which is occasionally practised in the cervix uteri, in order to facilitate delivery; but, this particular method is named the *Vaginal Cæsarean Operation*, for the purpose of distinguishing it from the former, which is frequently called, by way of contrast, the *Abdominal Cæsarean Operation*. With these cases, we have also to class the incision, which is made in the parietes of the abdomen, for the extraction of the fœtus, when, instead of being situated in the uterus, it lies in the cavity of the peritoneum, in consequence of the rupture of the womb; or in the ovary, or Fallopian tube, in consequence of an extra-uterine conception. This last operation, as Sabatier has remarked, is a species of gastrotomy. However, as it is analogous to the abdominal and vaginal Cæsarean Operations, it can be most conveniently treated of in the present article.

VAGINAL CÆSAREAN OPERATION.

Disease, malformation, or a preternatural position of the cervix uteri, may render this practice indispensable. A scirrhus hardness of the neck of the uterus is the most frequent. When the induration is such that the cervix cannot become dilated, and the patient is exhausting herself with unavailing efforts, the parts should be divided in several directions. This has been successfully done under various circumstances. Cases have been met with, in which the cervix uteri presented no opening at all, and yet the preceding operation proved quite effectual. Such is the example, which Dr. Simson has inserted in the third volume of the *Edinburgh Essays*. A woman, forty years of age, became pregnant, after recovering from a difficult labour, in which the child had remained several days in the passage. She had been in labour sixty hours; but the neck of the womb had no tendency to dilate. Dr. Simson, perceiving that its edges were adherent, and left no opening betwixt them, determined to practise an incision, with the aid of a speculum uteri. The bistoury penetrated to the depth of half an inch before it got quite through the substance, which it had to divide, and which seemed as hard as cartilage. As the opening did not dilate, in the efforts which the woman made, it became necessary to introduce a narrow bistoury on the finger, in order to cut this kind of ring in various directions. There was no hemorrhage; and the only additional suffering, which the patient encountered, arose from the distention of the vagina. As the child was dead, Dr. Simson perforated the head, in order to render the delivery more easy.

Strong convulsions, at the moment of parturition, may create a necessity for the vaginal Cæsarean Operation. These some-

times subside, as soon as the membranes are ruptured, and the waters discharged, so as to lessen the distention of the womb. However, if the convulsions were to continue, and the cervix uteri were sufficiently dilated, the child should be extracted with the forceps, or by the feet, according to the kind of presentation. On this subject Baudeloque has recorded a fact, which was communicated to the Academy of Surgery, by Duboeq, professor of surgery at Toulouse. The woman was forty years of age, and had been in convulsions two days. She was so alarmingly pale, that she could scarcely be known. Her pulse was feeble, and almost extinct, and her extremities were cold, and covered with a clammy perspiration. The edges of the opening, which was about as large as a crown piece, felt, as it were, callous, and hardly had this aperture been dilated, when delivery took place spontaneously. The child was dead. The symptoms were appeased, and the woman experienced a perfect recovery. Another case, in which the indurated cervix uteri was successfully divided, is recorded by Lambron, a surgeon at Orleans. (See *Dict. des Sciences Med.* T. 23, p. 297.)

A considerable obliquity of the neck of the womb, combined with a pelvis, of small dimensions, may also be a reason for the performance of the vaginal Cæsarean Operation. Not that such obliquity always occasions that of the rest of the uterus; nor is the neck of this viscus invariably directed towards that side of the pelvis, which is opposite to its fundus, although this is sometimes the case. In the latter circumstance, as the contractions of the uterus do not produce a dilatation of its cervix, which rests upon the bones of the pelvis, the adjacent part of that organ is dilated and pushed from above downwards, so as to present itself in the form of a round smooth tumour, without any appearance of an aperture. Such a case may have fatal consequences. Baudeloque furnishes us with an instance. A woman, in her first pregnancy, not being able to have the attendance of the accoucheur, whom she wished, put herself under the care of a midwife, who let her continue in labour pains during three days. When the accoucheur came, on being sent for again, the child's head presented itself in the vagina, covered with the womb. The portion of the uterus, which included the fœtus, was in a state of inflammation. The os tincæ was situated backward, toward the sacrum, hardly dilated to the breadth of a penny piece, and the waters had been discharged a long time. The patient was bled, and emollient clysters were administered. All sorts of fomentations were employed. She was laid upon her back, with her pelvis considerably raised. The accoucheur had much difficulty in supporting the head of the child, and keeping it from protruding at the vulva, enveloped, as it was, in the uterus. Notwithstanding such assistance, the patient died.

So fatal an event, says Sabatier, might have been prevented, by making the woman lie upon the side, opposite the deviation of the uterus, and employing pressure from above. If these proceedings had failed in bringing the os tincæ toward the centre of the pelvis, this opening might have been brought into such position, by means of the finger, in the interval of the pains, and kept so, until it were sufficiently dilated for the membranes to protrude.

This is what was done by Baudeloque in one case, where the womb inclined forward and to the right. The os tincæ was situated backward. The waters escaped, and the head advanced towards the bottom of the pelvis, included in a portion of the uterus. The whole of the spherical tumour which presented itself, could be felt with the finger; but, no opening was distinguishable; and the swelling might also be seen, on separating the labia from each other, and opening the entrance of the vagina. It became necessary to keep the patient continually in bed, and to have the finger incessantly introduced; but, she was not sufficiently docile to submit to such treatment. Fortunately, the unexpected appearance of two officers of justice, forty-eight hours after the commencement of the labour, had the effect of making her more manageable. It was time for her to become so; for the uterus had now become tense, red, and painful. The abdomen was also so tender, that it could scarcely bear the contact of the clothes. Febrile symptoms had begun, and the ideas were beginning to be confused. Baudeloque made her lie down; and he pressed, with one hand, on the abdomen, for the purpose of raising the uterus, while, with the other, he pushed the head a little way back, in order that he might reach the os tincæ, which he now brought with his finger toward the centre of the pelvis, and kept there for some time. The efforts of the patient being thus encouraged, she was delivered in about a quarter of an hour.—The infant was of a thriving description, and the case had a most favourable termination.

When the obliquity of the uterus is such that the os tincæ cannot be found, and the mother and fetus are both in danger of perishing, it is the duty of the practitioner to open the portion of the womb, that projects towards the vulva. Lauverjat met with a case of this description in his practice. A woman, pregnant with her first child, suffered such extreme pain in her labour, that Lauverjat was solicitous to ascertain the real state of things. He was surprised to find the vulva completely occupied by a body, which even protruded externally, and yielded to the pressure of the fingers, except during the labour pains.—In examining this tumour, he could only find at its circumference a cul-de-sac, half an inch deep, without any aperture, through which the child could pass. Other

practitioners, who were consulted about this extraordinary case, were also anxious to learn what had happened. They found in the tumour a laceration, which only affected a part of the thickness of its parietes. This laceration was deemed the proper place for making an incision. The operation having been done, the finger was passed into the cavity, in which the child was contained. A large quantity of turbid fluid was discharged. The child presented, and passed through the opening, with a trivial laceration on the right side. Lauverjat, having passed his hand into the uterus, was unable to find either the os tincæ, or the cervix. No particular indisposition ensued, and the lochia were discharged through the wound, which gradually closed. In the course of two months, the os tincæ and neck of the uterus, were in their natural position again. (*Lauverjat Nouvelle Méthode de pratiquer l'Operation Cæsarienne, Paris. 1788.*)

When the case is a scirrhus induration of the cervix uteri, or a laceration of the parietes of this viscus, at the place, where it projects into the vagina, the vaginal Cæsarean Operation is attended with no difficulty. It is performed with a blunt-pointed bistoury, the blade of which is wrapped round with lint to within an inch of the point. The instrument is to be introduced, under the guidance of the index finger, into the opening presented by the uterus, and the aperture is to be properly enlarged, from within outwards, in various directions. But when the scirrhus hardness of the cervix presents no opening at all, or when the part of the uterus projecting in the vagina is entire, the incision should be made from without inwards, with the same kind of knife. Too much caution cannot be used in introducing the instrument, in order that no injury may be done to the child, which lies directly beyond the substance, which is to be divided. No general direction can here be offered, except that of proceeding slowly, and of keeping the index finger extended along the back of the knife, so that it may be immediately known, when the substance of the womb is cut through, into the cavity of which the finger ought to pass as soon as the knife. If it should be necessary to extend or multiply the incisions, the cutting instrument should be regulated in a similar manner with the same finger. The cervix uteri having been divided, the expulsion of the child is either to be left to nature, or to be promoted by the ordinary means.—The operation that has been described, requires no dressings. If the bleeding should prove troublesome, we are recommended to apply to the incision a dossil of lint, wet with vinegar, or spirit of wine. (See *Sabatier's Médecine Opératoire, T. 1.*) The chief object would here be to prevent adhesions between the cervix of the uterus and the upper part of the vagina. (*Diction. des Sciences Med. T. 23, p. 298.*)

ABDOMINAL CÆSAREAN OPERATION.

This is a far more serious operation than that of which we have just now been treating, and it is the proceeding, to which the term Cæsaean Operation is more particularly applied.

There are three cases, in which this operation may be necessary. 1. When the fœtus is alive, and the mother dead, either in labour, or the last two months of pregnancy. 2. When the fœtus is dead, but cannot be delivered in the usual way on account of the deformity of the mother, or the disproportionate size of the child. 3. When both the mother and child are living, but delivery cannot take place from the same causes as in the second example.

In many instances, both mother and child have lived after the Cæsaean Operation, and the mother even borne children afterwards. (See *Heister's Institutes of Surgery*, chap. 113. *Mem. de l'Acad. de Chirurgie*, Tom. 1, p. 623, Tom. 2, p. 308, &c. *Edinb. Med. Essays*, Vol. 5, art. 37, 38. *Edinb. Med. and Surgical Journal*, Vol. 4, p. 179. *Med. Chir. Trans.* Vol. 9, and 11, &c.)

In England, the operation has been attended with remarkable ill success; and perhaps there is not one unequivocal example, in which the mother has here survived the true Cæsaean Operation. In the last edition of this work, indeed, I referred to the case recorded by Mr. James Barlow, of Chorley, Lancashire, who made an incision into the abdomen, extracted a dead child, and saved the mother's life.—(See *Medical Records and Researches*, p. 154, 1798.) My friend Dr. Gooch, however, having obligingly communicated to me his doubts, and those of Dr. Hull, respecting the reality of an incision having been made in this instance into the uterus. I am glad to have the opportunity of expressing my perfect conviction of the more correct view of the case taken by these physicians. "I suspected, from the first, (says Dr. Hull) that Mr. Barlow was deceived in this case, from the account he gave of the remarkable thinness of the uterus. And I had formed an opinion that the child had escaped through a laceration of the uterus, into the abdomen, enveloped in the secundines, and that he had merely divided the membranes, when he fancied he had divided the uterus." Dr. Hull then proceeds to explain the confirmation of his own sentiments by those of Mr. Howarden, a very intelligent practitioner at Blackrod, who assisted at the operation. In fact, the particulars stated by this gentleman, leave no doubt, that the fœtus had escaped through a laceration of the uterus into the cavity of the abdomen. (See *Hull's Defence of the Cæsaean Operation*, &c. p. 72.) The case also referred to by Mr. D. Stewart, (see *Edin. Med. Essays*, Vol. 5,) where the labour had endured twelve days, and the life of the mother was saved, after the dead fœtus had been extracted by a midwife, was also probably of the same nature: at

all events, the want of authentic particulars, and the circumstance of the operation having been done by a woman, leave the true nature of the case questionable.

If therefore, when we speak of the Cæsaean Operation, we mean that, in which the parietes of the abdomen and those of the uterus are divided by the surgeon, and the fœtus extracted, I believe that, as far as the history of the practice extends in this country, it cannot be said, that the mother has ever recovered after such a proceeding; though some years ago, a calculation was made, that the operation had been done not less than eighteen times in Great Britain. Ten of the children, however, are stated to have been saved. On the continent, the practice has proved infinitely more successful; for, of 231 cases of this operation, to be found in the records of medicine, 139 are said to have terminated successfully. (*Kellie, in Edin. Med. and Surgical Journal*, Vol. 8, p. 17.) No doubt, the ill success of the Cæsaean Operation in England was correctly explained by Dr. Hull: "In France, and some other nations upon the European Continent, the Cæsaean Operation has been, and continues to be performed, where British practitioners do not think it indicated; it is also had recourse to early, before the strength of the mother has been exhausted by the long continuance and frequent repetition of tormenting, though unavailing pains, and before her life is endangered by the accession of inflammation of the abdominal cavity. From this view of the matter, we may reasonably expect, that recoveries will be more frequent in France, than in England and Scotland, where the reverse practice obtains. And, it is from such cases as these, in which it is employed in France, that the value of the operation ought to be appreciated. Who would be sanguine in his expectation of a recovery under such circumstances, as it has generally been resorted to in this country, namely, where the female has laboured for years under *malacosteon*, (*mollities ossium*) a disease hitherto in itself incurable; where she has been brought into imminent danger by previous inflammation of the intestines; or other contents of the abdominal cavity; or been exhausted by a labour of a week's continuance, or even longer." Dr. Hull thus refutes the opinion of Mr. W. Simmons, that our ill success was owing to climate, or some peculiarity in the constitutions of the females of this island.—(See *Hull's Defence of the Cæsaean Operation*, p. 10.)

When the fœtus is contained in the womb, and cannot be expelled, by reason of the invincible obstacles to which I have already referred, the Cæsaean Operation should be practised before the mother and fœtus both perish from the violence of the pains, hemorrhage, convulsions, &c.

For this purpose it is necessary to make an extensive incision in the integuments of the abdomen, and in the uterus. Some

have thought, that cutting the parietes of the belly would be mortal, while others have believed a wound of the uterus equally dangerous. Hence, such persons have condemned the operation on the principle, that religious reasons do not authorize taking one life to save another. All the opponents of the Cæsarean Operation fear the hemorrhage, which, they say, must follow. Indeed, if the uterus were not to contract sufficiently, when the fœtus and after birth had come away, the bleeding would really be perilous. But when, by means of the Cæsarean Operation, the fœtus is extracted, together with the placenta and membranes, the uterus contracts, just as it does after a natural labour. Besides, even when the mother is alive, the operation is not commonly done, till the uterus evinces a propensity to deliver itself, and begins to contract. The womb being delivered of its contents, the incision becomes closed, the vessels obliterated, and there is no fear of hemorrhage. The wound must also make so irritable an organ more disposed to contract; but, whatever arguments may be adduced, it is enough to say in this case: *Artem experientia fecit, exemplo monstrante viam*. Rousset, in 1581, published a work in French, entitled *Hystérotomie, ou l'Accouchement Césarien*. This book, in 1601, was translated into Latin, and enlarged with an appendix by the celebrated Bauhin. Even then, the practice of the Cæsarean Operation on the living mother had its defenders. Bauhin relates that, in the year 1500, a sow-gelder performed the Cæsarean Operation on his wife, *tam feliciter, ut ea postea gemellos et quatuor adhuc infantes enixa fuerit*. This is said to be the first instance, in which the operation was ever done on the living mother with success. Many other cases were afterwards collected and published.

The possibility of operating successfully on the living mother, was proved with great perspicuity and accuracy, by Simon, in the *Memoires de l'Acad. de Chirurgie*, T. 1, 4to. Here we are presented with a collection of sixty-four Cæsarean Operations; more than a half of which had been done on thirteen women. Some of these had undergone the operation once or twice; others five or six times. There was one woman in particular, who had undergone it seven times, and always with success. This seems to prove, notwithstanding all assertions to the contrary, that the operation for the most part succeeds. But, if the life of the mother should not invariably be preserved, the Cæsarean Operation ought not to be rejected on this account: it ought always to be done, when relief cannot be obtained by other means; just as amputation and lythotomy are practised, though they are not constantly followed by success. Would any thing be more cruel, than to abandon a mother and her child, and leave them to perish, while there is any hope of saving them both? It is true, that when a pregnant woman dies

of any inward disorder, and not from the pains and efforts of labour, the fœtus is sometimes still alive in the uterus; but, in cases of death after difficult labours, and the great efforts made by the uterus to overcome the obstacles to parturition, the fœtus is generally dead; and the operation therefore is less likely to be availing. (See *Bertrandi Traité des Opérations de Chirurgie*, chap. 5.)

It is the opinion of the best writers upon this subject, that whenever a woman dies, at all advanced in pregnancy, the performance of the Cæsarean Operation is highly proper. The propriety of this practice, in such circumstances, was known to the ancient Romans; for, by a decree of Numa Pompilius, no woman, who died pregnant, was suffered to be buried, ere her body had been opened, with the view of preserving the infant for the use of the state. (*Sprengel Geschichte der Chir. Th. 1, p. 371.*) Experience has proved, that when the fœtus has not attained the period, at which parturition commonly happens, it will sometimes survive the operation a considerable time, and that, when it is full grown, its life may be most happily preserved.— Although instances are cited, in which the fœtus in utero has been found alive upwards of four and twenty hours after the death of the mother, little stress should be laid on such prodigies. The operation ought to be done without any delay. Even then, we are not certain of saving the infant's life. In the greater number of instances, the fœtus perishes at the same time with the mother, and from the same causes. The cases which are recorded of the fœtus being extracted alive, after the death of the mother, are numerous: I shall here only refer to three, two of which rest on the unimpeachable authority of Flajani, who was himself the operator. (*Collezione di Osservazioni, &c. di Chirurgia*, T. 3, p. 144—146.) In one of these instances, the operation was done on a woman killed by violence in the ninth month of pregnancy: the child lived six hours; in the other, a fœtus was extracted from a woman who had died of typhus fever, in the seventh month, and though the operation was not done till she had been dead about an hour, the child was taken out alive, and continued to live full ten minutes. A living child was also taken out of its mother by Vesling, after her death from typhus. (*Welsch. Obs. Med. Episagm. No 74, p. 47: Sprengel Geschichte der Chir. Th. 1, p. 374.*) With respect to the statements of Cangiamila, a Sicilian practitioner, I join Sprengel in considering them as incredible exaggerations; five instances are given, in which the fœtus was taken out of the mother from fifteen to twenty-four hours after her death, and yet continued to live. Cangiamila says, that at Syracuse, in the course of eighteen years, the operation had been practised twenty times under the same circumstances; that at Girgenti, thirteen children were saved out of twenty-two

women, who had died pregnant; and that, in twenty-four years at Montereali, twenty-one children were preserved in the same manner. (*Embryologia Sacra. Venet. 1763. fol.*) As Sprengel remarks, one might almost suppose, from this account, that in Sicily pregnancy was generally fatal. If the mother should happen to die in labour, and the neck of the uterus were sufficiently dilated, or disposed to be so, an attempt should be made to accomplish delivery in the ordinary way; for, examples have occurred, in which women, supposed to be dead in this circumstance, were in reality alive. Hence, we find, that the senate of Venice in 1608 enacted a law, by which practitioners were liable to punishment, in case they neglected to operate with as much caution on a pregnant woman, supposed to be dead, as on the living subject; and rules to be observed were again issued by the same government, in 1720. (*Seb. Melli La Comare levatrice, p. 108, 4to Venez 1721; Personè Diss. sopra l'Operaz. Cesar p. 15, 8vo. Venez. 1778.*) A law to the same effect was likewise made in 1749, by the king of Sicily, who decreed the punishment of death to those medical men, who omitted to perform the Cæsarean Operation on such women as died in the advanced stages of pregnancy. In the *Journal de Savans de Janvier, 1749*, the following case, confirming the propriety of such caution, was inserted by Rigaudeau, surgeon to the Military Hospital at Douay. This practitioner, having been sent for to a woman, to whose residence he was unable to proceed, till two hours after her apparent death, he had the sheet, with which she was covered, removed, and perceiving that the body retained its suppleness and warmth, he tried whether the fœtus could not be extracted in the ordinary way, which was easily effected as soon as the feet were got hold of. The first endeavours to save the child were very unpromising; but, after a few hours, they had the desired effect. As the woman continued in the same state five hours afterwards, Rigaudeau recommended that she might not be buried before her limbs were quite cold and stiff. He afterwards had the satisfaction to learn, that she was also restored to life. This remarkable case happened on the 8th of June, 1745, and both the mother and child were living at the period, when Rigaudeau published the observation.

Supposing, however, delivery in the ordinary manner, to be impracticable, at all events, the Cæsarean Operation ought to be performed, with the same cautions, as if the mother were alive, only one incision being made for the purpose of opening the uterus.

Almost all the insurmountable obstacles to delivery originate from the bad conformation of the pelvis, depending upon rachitis; though they are not an invariable consequence of it, since there are women, extremely deformed, in whom no imperfec-

tion of the pelvis exists, while it prevails in others, whose shape is but trivially disfigured. An examination of the dimensions of the pelvis is the right mode of ascertaining, whether there is really such an impediment to parturition. In order that the dimensions may not be an obstacle to delivery, the distance, between the upper edge of the sacrum and the os pubis, ought to be three inches and a half; and the distances between the tuberosities of the ischium, and between each of these protuberances and the point of the os coccygis, three inches. Women have indeed been known to be delivered, without assistance, although the first of the above distances was only two inches and a half; but, then the heads of the children were so elongated, that the great diameter was nearly eight inches, while that which extends from one parietal protuberance to the other, was reduced to two inches five or six lines, and the infants were lifeless. If they are to be born alive, they must be taken out of the womb by the Cæsarean Operation: but, the latter proceeding should never be adopted, without a certainty, that they are actually living; for, when dead, they may be extracted in a way, that is attended with much less risk to the mother.

It is not always an easy matter to ascertain with certainty, whether a fœtus in utero, be living or dead. If it has entirely ceased to move, after being affected with a violent motion, the probability is, that it is no longer alive. But, to be certain, manual examination is necessary, which may be practised in two ways. One consists in pressing upon the uterus, through the parietes of the abdomen. If the child lives, such pressure makes it move, and the motion can be plainly felt, and distinguished. In the other method, one hand is employed in pressing upon the uterus externally, while, with the fingers of the other hand, passed up the vagina, corresponding pressure is also to be made. The uterus is likewise to be allowed to descend as far as possible, in order to induce the fœtus to move. When no decisive indications can be thus obtained, it becomes necessary to rupture the membranes, if they have not already given way, introduce the hand into the uterus, and put a finger into the child's mouth, for the purpose of making it move its tongue. The finger may also be applied to the region of the heart, so as to examine whether this organ is beating; and the umbilical cord may be touched, in order to ascertain whether there is still a pulsation in it. When none of these proceedings furnish unequivocal information, the conclusion is, that the child is dead, and its extraction is indicated, unless the narrowness of the parts be such, that the hand cannot be passed into the uterus, in which case, the Cæsarean Operation is indispensable.

But, how are we to form a judgment respecting the dimensions of the pelvis? And how can we know, whether that diameter, which extends from the upper edge of the

sacrum to the os pubis, is long enough to allow the passage of the child? The proper confirmation of this part is known, by the roundness and equality of the hips, both in the transverse and perpendicular direction; by the projection of the pubes; by the moderate depression of the sacrum; by an extent of four or five inches from the middle of this depression to the bottom of the os coccygis; by an extent of seven or eight inches from the spinous process of the last lumbar vertebra to the highest part of the mons veneris, in a woman moderately fat; and by there being an interspace of eight or nine inches, between the two anterior superior spinous processes of the ossa ilium.

These general calculations, however, are insufficient. In order to acquire more correct opinions, double compasses have been employed. The branches of the first being applied to the top of the sacrum, and middle of the mons veneris, three inches are to be deducted from the dimensions, indicated by the instrument; viz. two inches and a half for the thickness of the upper part of the sacrum, (which is said to be constant in subjects of every size,) and half an inch for that of the os pubis. In women, who are exceedingly fat, some lines must also be deducted on this account. Hence, when the total thickness of the pelvis, measured in this direction, is seven inches, there will remain four for the distance from the upper part of the sacrum to the os pubis, or for the extent of the lesser diameter of the upper aperture of the pelvis.

For taking the measurement internally, a kind of sector was invented by Coutouly. It bears a considerable resemblance to the instruments employed by shoemakers for measuring the feet. It is passed into the vagina, with its two branches approximated, until one arrives opposite the anterior and upper part of the sacrum, when the other is to be drawn outward, so as to be applied to the pubes. The distance between the branches, is judged of by the graduations on the instrument. This was named by its inventor a pelvimeter. According to Sabatier, it is not always easy to place it with accuracy; its employment is attended with some pain; and there are particular cases in which it cannot be used.

Instead of this contrivance, the celebrated Baudeloque recommended a means, which seems to be very safe and simple. The index finger of one hand is to be introduced into the vagina to the upper part of the projection of the sacrum. The finger, having the radial edge turned forwards, is then to be inclined anteriorly till it touches the arch of the pubes. The point of contact being then marked with the opposite hand, the length from the point in question to the end of the finger is to be measured. This length, which indicates the distance between the sacrum and the bottom of the symphysis pubis, usually exceeds that of the lesser diameter of the pelvis by about six lines. Baudeloque acknowledges, that this measurement is not exactly accurate;

but, he believes, it will do very well, because, unless the narrowness of the pelvis be extreme, two, or three lines hardly make any difference in the facility of parturition.

The following is the description of the pelvis of the woman, twice operated upon by Dr. Locher: the ossa pubis, which should be on the same level with the promontory of the sacrum, were found perpendicularly under it; so that the child necessarily extended the abdominal integuments by its own weight, into a pendulous bag overhanging the thighs. For the same reason, nothing could be felt of the child by examination per vaginam. The sacrum, instead of closing the pelvis behind, by a semi-circular curve, which forms a kind of conductor for the child in parturition, stretched nearly horizontally backwards. A representation of this pelvis, with a few other particulars, may be seen in a modern publication. (*Med. Chir. Trans. Vol. 11, p. 199.*)

The pelvis may be every where well formed, and yet present an insurmountable obstacle to delivery, in case an exostosis, lessening its dimensions, should exist on one of the bones, which compose this part of the skeleton. Pineau met with a case of this description in a woman, who died undelivered. The tumour originated from one of the ossa pubis. A steatomatous swelling situated with the head of the child in the upper aperture of the pelvis, might produce the same effect, unless it were detected, and could be pushed out of the way, so as to make room for the fœtus to pass. Baudeloque mentions a swelling of this kind. It was six or seven inches long, and an inch and a half in width. The extremity of it, which was as large as half an hen's egg, had a bony feel, and contained nine well-formed teeth, the rest of the mass being steatomatous. It had descended into the lesser pelvis, below the projection of the sacrum, and a little to one side. It might have been taken for an exostosis of this last bone. The labour pains continued sixty hours, and the propriety of performing the Cæsarean Operation was under consideration. Baudeloque was averse to this proceeding. He recommended turning the child, and extracting it by the feet, because he thought, that the pelvis was sufficiently capacious to admit of delivery. The event proved, that it was three inches nine lines, from before backward, and four inches nine lines transversely. The fœtus was soon easily extracted. The assistance of the forceps was necessary to get out the head. The child was stillborn. The mother, exhausted with numerous unavailing efforts, only survived between 50 and 60 hours. Baudeloque was of opinion, that a defective regimen also tended to occasion her death.

Among the insurmountable obstacles to delivery may be reckoned such a displacement of the uterus, that this viscus protrudes from the abdomen, and forms a hernia. The records of surgery have preserved some examples of this extraordinary occurrence. Twice has the Cæsarean Operation

been performed, and, in one of the cases, the woman survived so long, that hopes were entertained of her recovery. Indeed, as Sabatier observes, why should not the operation succeed in such a case, where the uterus is only covered by the integuments, and there is no occasion to cut into the abdomen, just as well as other instances, in which it is indispensable to divide the muscles, and open the cavity of the belly? In the other case on record, delivery was effected in the ordinary way, either by raising the abdomen, and keeping it in this position with towels skilfully placed, or by making pressure on the uterus, which had the beneficial effect of making this organ resume its proper situation.

Having shown the absolute necessity for the Cæsarean Operation, under certain circumstances, it remains to consider the proper time for performing it, the requisite preparatory means, and the method of operating.

With regard to the time of operating, practitioners do not agree upon this point; some advising the operation to be done, before the membranes have burst, and the waters been discharged; others, not till afterwards. The arguments, in favour of the first plan, are, the facility with which the uterus may be opened without any risk of injuring the fœtus, and the hope that the viscus will contract with sufficient force to prevent hemorrhage. The advocates for the second mode believe, that, in operating after the discharge of the waters, there is less danger of the uterus falling into a state of relaxation, in consequence of becoming suddenly empty after being fully distended, and that this method does not demand so extensive an incision. Hence, they recommend, as a preliminary step, to open the membranes. Whatever conduct be adopted, it is essential, that the labour should be urgent and unequivocal, that the cervix uteri should be effaced, and that the os tincæ should be sufficiently dilated to allow the lochia to be discharged; but, at the same time, says Sabatier, if the operation is not to be done till after the escape of the waters, there ought not to be too much delay, lest the patient's strength should be exhausted, and the violent efforts of labour should bring on an inflammatory state of the parietes of the uterus.

The propriety of emptying the rectum and bladder is so evident, that it is unnecessary to insist upon it. This precaution is more particularly requisite in regard to the latter of these viscera, which has been known to rise so much over the uterus, as to conceal the greater part of it. Baudeloque had occasion to remark this circumstance, in a woman, upon whom he was operating. The bladder ascended above the navel, and presented itself through the whole extent of the opening made in the parietes of the abdomen.

The instruments, dressings, &c. which may be wanted, are two bistouries, one with a convex edge, the other having

probe-point; sponges; basins of cold water acidulated with a little vinegar; long strips of adhesive plaster; needles and ligatures; lint; long and square compresses; a bandage to be applied round the body, with a scapulary, &c.

For the purpose of undergoing the operation, the patient should be placed at the edge of her bed, well supported; her chest and head should be moderately raised; her knees should be somewhat bent, and held by assistants, one of whom ought to be expressly appointed to fix the uterus by making pressure laterally, and from above downward, so as to circumscribe, in some degree, the swelling of the uterus, and prevent the protrusion of the bowels. These things being attended to, the integuments are to be divided with the convex-edged bistoury to the extent of at least six inches. The place, and direction of this incision, differ with different operators.

In the most ancient method, it was customary to make the incision between the outer edge of the rectus muscle, and a line, drawn from the anterior superior spinous process of the ilium, to the junction of the bone of the first rib with its cartilage. This cut was begun a little below the umbilicus, and was continued downward as far as an inch above the pubes. After the integuments had been divided, the muscles, aponeuroses, and peritoneum were cut, and the uterus, cautiously opened. The left index finger was then introduced into this viscus, the wound of which was dilated by means of the probe-pointed bistoury.

This manner of operating is subject to great inconveniences. The place, where the incision is made, is the situation of muscles, the fibres of which have a different direction, and, on contracting, separate the edges of the wound, and make it gape. The considerable blood vessels, which ramify there, may be the source of perilous bleeding. The bowels can protrude in that situation more readily, than any where else. When the position of the uterus is oblique, and when, consequently, the edges of this viscus are turned forward and backward, and its surfaces to the right and left, the incision will be made in one of the lateral portions of the uterus, where the trunks of its blood-vessels are known to be situated, and sometimes even the Follapian tube and ovary may be cut. The fibres of the uterus are cut transversely, so that the edges of the incision are apt to gape, instead of being in contact. This last circumstance may the more readily permit the lochia to escape into the abdomen, inasmuch as the uterus is cut nearly through its whole length, and there is no cavity, in which they can accumulate, in order to be discharged through the cervix of that organ.

The linea alba has been frequently considered the most eligible place for making the incision. As Sabatier informs us, it was the method adopted by Soleyres and Dealeurye, and it has the recommendation of

Baudeloque, because there are fewer parts to be cut, and, when the uterus is exposed, an incision, parallel to its principal fibres, may be made in its middle part. Soleyres thought that this plan of operating originated with Platner and Guérin, a surgeon at Crepi en Valois, Platner says; *Incidantur juxta lineam albam, plagâ majore quæ ab umbilico ad ossa pubis ferè descendit, tum abdominis muscoli, tum peritonæum, ubi tandem vitandum ne violetur arteria epigastrica.* Guérin, in his case, made an incision, six inches long, which began a little above the umbilicus, and extended to within an inch and a half of the pubes. He afterwards divided the fat, muscles, and peritonæum, in order to get at the uterus, the anterior part of which was opened, the wound being made rather in the body, than the fundus of that viscus. Deleurye will not admit, that these writers actually divided the linea alba, because they speak of having cut muscles, which in reality do not exist in that situation; and he attributes the honour of the invention to Varoquier, a surgeon of Lisle, in Flanders; but, the method was known to Mauriceau, as we may be convinced of by the following passage, extracted from the chapter in which he treats of the Cæsarean Operation, "*La plupart veulent qu'on incise au côté gauche du ventre; mais l'ouverture sera mieux au milieu entre les muscles droits, car il n'y a en ce lieu, que les tégumens et les muscles à couper.*" Lauerjat, who has made this remark, and cited the Latin edition of Mauriceau, page 247, also observes, that the incision in the linea alba was practised by a contemporary of La Motte, a circumstance which Sabatier has not been able to ascertain. (*Médecine Opératoire, Tom. 1.*) The following would be the proper manner of operating in the linea alba. The operator should first divide the integuments perpendicularly, so as to expose the linea alba, making the wound about six inches long. An opening should then be carefully made through the aponeurosis, into the abdomen, either at the upper, or lower part, of the linea alba in view. A curved bistoury is then to be introduced into the opening, and the tendon and peritonæum cut from within outward, as far as the extent of the wound in the integuments. The latter cut should be cautiously made, with the crooked bistoury, guided by the forefinger of the left hand, lest any of the intestines be accidentally injured. The uterus must next be carefully opened, making an incision in it, of the same length, as the preceding wound. The fœtus is to be taken out through the wound, and then the placenta and membranes. In this way, M. Artiste lately operated, so as to save both mother and child. (See *Edinb. Med. & Surg. Journ. Vol. 4, p. 178.*)

This mode of operating, as Sabatier observes, gives more hopes of success, than the plan first described; but he argues, that such hopes have not been realized by experience. Though the operation may have been more easy, he contends that the

edges of the wound in the skin, and those of the incision in the uterus, have had no tendency to remain in a state of proximity to each other, because the linea alba is the point, on which all the large muscles of the abdomen principally act, and because the contraction of the uterus invariably takes place from above downwards. Sabatier alleges, that the wound in this viscus has been found to incline to one of its sides, for the same reasons, as occur, in operating at one of the sides of the abdomen. He also states, that the incision has been concealed under the integuments of the upper part of the pubes, and that the presence of the bladder hinders the wound from being carried sufficiently far down. Perhaps, says he, a part of these inconveniences which depend upon the contraction of the uterus, and the return of this organ to its natural state, might be avoided, by extending the incision to its highest part. Baudeloque has advised this plan, with a view of preventing the fatal extravasations in the abdomen, which frequently follow this operation. Sabatier, however, has doubts, whether, in operating in the linea alba, the wound can be carried high enough. Besides, he maintains, that this precaution would not prevent the wound from gaping, nor the greater tendency of the lochia to be extravasated in the abdomen, than to accumulate in the uterus, and be discharged through the os tincæ. (*Médecine Opératoire, Tom. 1, p. 274, 275.*)

In this country, (where, indeed, the Cæsarean Operation has proved most unsuccessful) the linea alba is preferred, I believe, by the majority of practitioners. That the method is not always attended with the formidable objections, urged against it by Sabatier, is quite certain: the case, lately published by Dr. Chisholm, is a decisive proof of this assertion. (See *Edinb. Med. and Surgical Journ. Vol. 4, p. 178, 179.*)

There is a third method of performing the abdominal Cæsarean Operation. It consists in making a transverse incision, five inches in length, through the parietes of the abdomen, between the rectus muscle and the spine, and in a situation more or less high, according to the more or less elevated position of the uterus. This plan was recommended by Lauerjat, in a publication entitled, "*Nouvelle Méthode de Pratiquer l'Operation Césarienne, Paris, Sup. 1788.*" Lauerjat acknowledges, that the method had been successfully practised by different persons before himself, and, especially, in one instance, which was particularly remarkable, as, in consequence of the first incision having been made too high up, it became necessary to make a second one, which extended obliquely from the other. However, according to Sabatier, Lauerjat has as much merit, as if he had invented the plan, since he has given a better explanation of its advantages, than any of his predecessors.

The side, on which the operation is to be done, is in itself a matter of indifference,

But, if the liver or spleen were to project, one ought to avoid it. Also, if the uterus were to incline more towards one side, than the other, it would be proper to operate on that side, where this viscus could be most conveniently exposed. The patient being put in a proper position, and held by assistants, and her abdomen kept steady by an attendant, who must apply the palms of his hands to the sides of the uterus, the integuments, muscles, and peritoneum are to be divided, with the usual precautions. The uterus is then to be opened, and the wound in it enlarged in the requisite degree, by means of a probe-pointed bistoury. Should the placenta present itself, care must be taken not to injure it, for fear of opening one of the arteries of this mass, which communicate with the umbilical arteries of the child, or of leaving a portion of it in the uterus; but, it should be separated, in order to facilitate breaking the membranes at its circumference. The child is next to be extracted. This part of the operation is subject to no general rule. Delivery being accomplished, we are recommended to introduce through the vagina anodyne injections, in order to lessen spasm, and wash out the coagula. This method is preferable to that of clearing out the uterus with the hand. Sabatier most properly condemns the plan, formerly advised by Rousset and Ruleau, of passing up the neck of this viscus, a catheter for the purpose of washing out the lochia, as well as the absurd proposal of employing a seton to promote their escape. Should the lochia not pass readily outward, we are recommended to introduce the finger occasionally into the cervix uteri, so as to free it from the coagula, which may obstruct it.

Sabatier observes, that nearly all authors, who have spoken of the Cæsarean Operation, whether performed at the sides of the abdomen, or in the linea alba, have advised keeping the edges of the wound in the skin, muscles, and peritoneum together, by means of the interrupted, or twisted suture, care being taken to place at the lower part of the incision a tent, in order to prevent adhesion, and leave a free issue for whatever discharge may take place from the abdomen. Others have been content with recommending the use of adhesive plasters and the uniting bandage.

Sabatier condemns sutures as painful and irritating, and he states, that the other means only act upon the skin, without fulfilling the object in view, because the integuments have no fixed point, and the divided muscles tend to contract. He assures us, that, in the last mode of operating, the edges of the wound may be brought into contact by merely laying the patient upon her side. Besides, he remarks, that there are not many muscular fibres cut, those of the transversalis being only separated from each other. He affirms, that this manner of operating also favours the approximation of the edges of the wound in the uterus, in consequence of this organ contracting

most extensively in the perpendicular direction. It is likewise asserted, that, as the uterus has only been opened at its upper part, it affords in its middle and lower portions a large cavity, which does not communicate with the abdomen, and in which the lochia may easily accumulate, and afterwards be discharged by the natural way. The only dressings, advised by Sabatier, are a large pledget, compresses, and a moderately tight bandage round the body. These are to be changed, when soiled with the matter or discharge. In this country, practitioners would not neglect to bring the edges of the wound, as much as possible together, by means of strips of adhesive plaster; for, though they may not act with so much effect in this situation as many others, they undoubtedly assist in promoting the main aim of the surgeon, which is to heal at least all the upper part of the incision, if possible, by the first intention. I have no doubt, there are many, who would be advocates for sutures. In this country, the last method of operating has also been tried.

Mr. Wood, of Manchester, performed the Cæsarean Operation, in a case, in which parturition was prevented by deformity of the pelvis. The incision was made nearly in a transverse direction, on the left side of the abdomen, about five inches in length, beginning at the umbilicus. This part was fixed upon, because the nates of the child could be felt there, and it was evident, that no intestine was interposed betwixt the abdominal parietes and the uterus. There was scarcely any effusion of blood, either from the external wound, or from that of the uterus, though the latter was made directly upon the placenta. Instead of dividing the placenta, Mr. Wood introduced his hand betwixt it and the uterus, and, laying hold of one of the child's knees, extracted the fetus with ease. His hand readily passed betwixt the placenta and uterus; this produced a hemorrhage, but, not in any considerable degree; for, the whole quantity of blood lost did not exceed seven or eight ounces. After the uterus was emptied, the intestines and omentum protruded at the wound. These having been reduced, the integuments were brought into contact with sutures and adhesive plaster. This operation, however, did not save the woman's life; she died on the fourth day after its performance. (See *Med and Physical Journ.* Vol. 6.) As I have already explained, the ill success of the Cæsarean Operation in England has been such, that not a single case has yet happened, in which the life of the mother has been preserved after the child was truly extracted from the womb by incision. The probable reason of this circumstance I have also noticed. Abroad, however, the success of the practice forms quite a contrast, to what has occurred in this country, the operation having been often done so as to save the lives both of the mother and child, of which an interesting example was re-

cently published by Dr. Locher, of Zurich. (See *Med. Chir. Trans.* Vol. 9, p. 11.) And, in Vol. 11 of the same work, may be read a case, in which Dr. Meyer, of Minden, lately saved a woman, by the operation, but the fœtus was dead. Likewise an example, in which Dr. Spitzbarth, in 1819, preserved the lives both of the infant and mother; and another interesting relation of two Cæsaean Operations performed by Lorinser on a woman still living at Nîmes, in Bohemia. (See also *Siebold's Journ. für Geburtshulfe*, &c. Vol. 3, Part 1, Frankf. 1819.) In 1801, Dr. Schlegel, of Merseburg, likewise operated on a woman, who recovered, notwithstanding the bowels became strangulated, and she is still living, with a hernia in the situation of the wound. (*Schweigger's Archiv. des Accouchemens*, p. 135, 8vo. Paris, 1797.)

OF OPERATING, WHEN THE FŒTUS IS EXTRA-UTERINE.

Delivery cannot possibly happen in the ordinary way, when the fœtus is situated in the ovaries, or Fallopian tube, or in the cavity of the peritoneum. However, there are many instances recorded of ventral pregnancies, which the mothers survived, the dead putrid fœtus having been discharged, either out of an abscess, or through the rectum.

Practitioners are occasionally called upon to do a very similar operation to the Cæsaean, when the child has passed into the cavity of the peritoneum, in consequence of the rupture of the uterus. Unfortunately, such an accident is not uncommon, and though the causes of it may not be obvious, nothing is more certain, than that the fœtus itself is entirely passive, and has no share in producing the misfortune. The symptoms, by which the event can be known, are not always easy of comprehension. When, however, the pains have been violent; when the last, after being excessively severe, has been followed by a kind of calm; when the countenance loses its colour, the pulse grows weak, and the extremities become cold and covered with a cold sweat; when the abdomen is generally flat and only partially affected with a swelling, occasioned by the fœtus, which either continues to move, or is dead and motionless; when the patient complains of a moderate degree of heat about the belly; and, lastly, when the child shrinks from the touch of the accoucheur; it is manifest that the uterus is lacerated. If the child has passed completely into the abdomen, gastrotomy is the only resource. Should a part of it, however, yet remain in the uterus, it may be extracted, with the aid of the forceps, if the head presents, or by the feet, provided only the upper part of the body be in the abdomen.

Baudeloque quotes three instances of gastrotomy, performed on account of the rupture of the uterus. The first is that inserted by Thibaud Dubois in the *Journal de Médecine* for May, 1760. Every preparation was

made for a natural labour, when, after excessively violent pains about the upper and left part of the uterus, the child disappeared. Thibaud opened the abdomen, though not till some hours after the accident. The infant was dead; but, the mother experienced no ill effects after the operation, except such as are usual after the ordinary labours.

The second and third cases were communicated to the French Academy of Surgery in 1775, by Lambron, a surgeon of Orleans. He practised the operation twice, on the same woman, with success. In the first instance, he operated eighteen hours after the rupture of the uterus. The child was dead. An ill-conditioned abscess formed near the wound; but, the patient got quite well in the course of six weeks. She was pregnant again the following year, and the uterus was once more ruptured. Lambron now had recourse to the operation without delay. The child betrayed some signs of life; but soon died. The mother not only survived, but, afterwards became pregnant again, and had a favourable delivery.

In the foregoing column, I have adverted to the case, in which Dr. Locher, of Zurich, saved both the mother and child by the Cæsaean operation, performed in the linea alba. After her recovery, a small point of the wound, not exceeding two or three lines in length and breadth, required a long time to be quite healed, though no particular inconvenience was experienced from it. Some time afterwards, the cicatrix gave way again, and a portion of omentum protruded, which was reduced, when a piece of bowel came out, and was also returned. The edges of the wound were then brought together; but a small superficial ulcer continued open, in spite of every effort to close it. In 1818, the year following that in which the Cæsaean Operation had been performed upon her, she became pregnant again, and the chief particularity, which happened during gestation, was an increase in the size of the preceding ulcer, which became three inches in width. The sore, however, was covered with charpie, and the integuments well supported with adhesive plaster. On the 23d of May, she was seized with labour-pains; and about seven in the evening, she complained all at once of a very acute pain, and at the same moment voided a considerable quantity of blood from the vagina. On examining by this passage, nothing was discovered; but, when the hand was applied below the navel, in the line of the old wound, and under the ulcer, a circumscribed firm swelling was felt, caused by the child's head, of which the sutures were plainly discernible. Dr. Locher naturally concluded, that the uterus had burst, so as to allow the child to escape, and the hemorrhage was thus easily explained. A repetition of the Cæsaean Operation was deemed indispensable. The place of the incision was determined by the round swelling, caused by the child's head. An incision, six inches in length, was made into the abdomen, where a quantity of coa-

gulated blood was found. When this had been removed, the membranes presented themselves, exhibiting a bluish hue, and, after they had been opened, the head of the child immediately appeared. The navel-string passed round the neck, which was also compressed in the opening of the uterus. The child evinced no signs of life. The placenta came away during the attempts to reanimate the child. The uterus contracted, and there was little bleeding. This patient, after a good deal of indisposition, and occasional approaches to a perfect recovery, was at length attacked with inflammation of the stomach and bowels, and died on the 9th of July. The uterus was found contracted to a small size, with an opening, of about the size of an almond, on its anterior surface, with a rounded callous edge. This aperture, Dr. Locher thinks, had remained ever since the first operation, and had allowed the escape of the child in the second labour; a circumstance, which may be doubted, as the hemorrhage indicated the period, when the uterus had been lacerated, as this gentleman indeed has in one place particularly noticed himself. (See *Med. Chir. Trans.* Vol. 11, p. 182, &c.) An almost incredible case is related of, what may be called, a Cæsarean birth, effected solely by the powers of nature, and, as would appear, by a sudden rupture of the uterus and parietes of the abdomen, after the patient had been in labour three days. (See *Essays and Obs. Physical and Literary*, Vol. 2.)

A laceration in the uterus, or the wound, made in this viscus in the Cæsarean Operation, may give rise to dangerous and even fatal symptoms of strangulation, if any of the intestines insinuate themselves into the preternatural opening. When such an occurrence happens in the performance of the preceding operation, the intestine must be directly withdrawn and replaced. If the accident were to happen, when the child is extracted in the natural way, the bowel is to be pushed back into the abdomen from the uterus. Were the occurrence to take place several days after the operation, Sabatier inquires what ought to be done? A surgeon is said to have pushed back the intestine from the uterus as late as the third day. Sabatier thinks, that later it could not be done. In this circumstance, Baudeloque advises the operation, suggested by Pigrai, namely, that of opening the abdomen and withdrawing the bowel from the place, in which it is incarcerated. But, there are serious objections to this proceeding. There is no certainty that the intestine is strangulated, and, if it were so, the adhesions, which are soon formed, would frustrate the design of the operator.

Gastroto-my has not only been recommended for cases, where the child has passed into the abdomen through a rupture of the uterus; it has likewise been advised for instances, in which the fœtus has grown in the Fallopian tube, ovary, or cavity of the abdomen. Here, indeed, the operation de-

serves to be called Cæsarean; for, in addition to the incision in the skin and muscles of the abdomen, it is necessary to open the pouch, in which the child is contained. The instances of conceptions in the Fallopian tube are not uncommon. Those in the ovary, and cavity of the peritoneum, are more rare. Sabatier conjectures, that most of the cases, reported to be of the latter kind, if attentively examined, would have been found to be in reality conceptions in the Fallopian tube.

Extra-uterine conceptions hardly ever arrive at maturity. However, the fœtus, formed in the Fallopian tube, has sometimes been known to attain the term of nine months, and then die, either from the impossibility of its expulsion, or from the insufficiency of the nourishment afforded it. The pouch in which it was contained, and the neighbouring parts, have then inflamed, and after becoming connected together by numerous adhesions, have suppurated. The abscess has burst, partly at some point of the circumference of the belly, and, partly, into the rectum; and the dead fœtus has been discharged piecemeal with the matter.

In other examples, the fœtus, instead of giving rise to abscesses, has become ossified, with the enveloping membranes, and continued in this state many years, without any other inconvenience to the patient, than what depended on the size and weight of the tumour within the abdomen.

Most frequently, however, the pouch containing the fœtus, bursts, about the middle of the ordinary period of gestation, and the child passes into the cavity of the peritoneum. At the same moment, the blood-vessels, ramifying on the parietes of the containing parts, usually pour forth into the abdomen so much blood, that the patients generally die in the space of a few hours. (See a case by Dr. Clark in *Trans. of a Society for the Improvement of Medical and Chirurgical Knowledge*. Also another adverted to by Mr. C. Bell, in *Medico-Chirurg. Trans.* Vol. 4, p. 340.)

Sabatier acquaints us, that two facts of this kind fell under his observation. The women were in the end of the fourth month of pregnancy. Excepting a swelling, which affected only one side of the abdomen, and frequent dragging pains in this cavity, there was no indication of any thing extraordinary. In other respects, the patients were well. They were both, all on a sudden, attacked with extremely acute pains, which lasted two or three hours. A more violent suffering, than the rest, was followed by entire ease. The abdomen subsided, and became as it were flat. An equal moderate warmth diffused itself over this part of the body. The skin lost its colour. Almost continual syncope occurred. The pulse was feeble and concentrated. The whole body was covered with a cold sweat, and the women died. The rapid course of these symptoms rendered it impossible for Sabatier to be of any assistance. The patients were actually dying, when he

was called to them. The examination of their bodies evinced, that the abdomen contained a large quantity of blood: that the children lay on the intestines, connected with the lacerated Fallopian tube by means of the umbilical cord; and that the tube itself, which was strongly contracted, presented no other tumour, except that which depended on the after-birth.

There is nothing that announces an extra-uterine pregnancy, with sufficient certainty, to justify any positive conclusion, respecting the nature of the case, before the ordinary time of parturition. In many women, the gravid uterus inclines to one side, and numerous pregnant females have dragging pains, which may depend upon other causes. Things, however, are different when the fœtus has lived to the ordinary period of parturition, and the woman is attacked with labour-pains; because, besides the unequivocal signs of the presence of a child in the abdomen, the womb is empty, and is little changed from its common state. Should we now, asks Sabatier, have recourse to the Cæsarean Operation, just as if the fœtus were in the womb? Can we be sure, that the pouch, which contains the child, will contract itself, like the uterus, and that the incision, which is in contemplation, will not give rise to a fatal hemorrhage? Would it be easy to separate, and remove the whole of the placenta? How could the discharge, analogous to the lochia, find an outlet, and would not its extravasation in the abdomen, be likely to prove fatal? Sabatier thinks, that the risk, which is to be encountered, is much less when things are left to nature. The child, indeed, must inevitably perish. It will either give rise to abscesses, with which it will be discharged in fragments, or it will remain for a length of time in the abdomen, without any urgent symptoms. Sabatier also calls our attention to the great precariousness of an infant's life, and expresses his opinion, that there can be no difficulty in deciding what conduct ought to be adopted. Happily, practitioners are not often placed in circumstances so delicate, and extra-uterine conceptions mostly perish before the end of the common period of gestation. We have then only to second the efforts of nature; either by promoting suppuration, if it should seem likely to occur; by making a suitable opening, or enlarging one that may have formed spontaneously; by extracting such fragments of the fœtus as present themselves; by breaking the bones, when their large size confines them in the abscess, as Littre did in an instance, where the abscess burst into the rectum; and, lastly, by employing suitable injections. (See Sabatier's *Médecine Opératoire*, Tom. 1.)

An extremely uncommon case of extra-uterine conception, was related a few years ago by Josephi: the fœtus having at length passed into the bladder by ulceration, and caused such affliction, as rendered an incision into that receptacle indispensable with the view of extracting the parts of the

fœtus lodged in it. The operation was done above the pubes; but, the internal mischief already existing was so great, that the patient did not recover. (*Ueber die Schwangerschaft ausserhalb der Gebärmutter*; Rostock, 1803. 8vo.)

Govei, p. 401, relates a case of ventral conception, in which instance the Cæsarean Operation was done, and the child preserved. A lady, aged 21, had a tumour in the groin, which was at first supposed to be an epiplocele, but an arterial pulsation was perceptible in it. In about ten weeks, the swelling had become as large as a pound of bread. Govei, solicited by the lady, opened the tumour. He first discovered a sort of membranous sac, whence issued a gallon of a limpid fluid. The sac was dilated, and a male fœtus found, about half a foot long, and large in proportion. It was perfectly alive, and was baptized.—After tying the umbilical cord, the placenta was found to be attached to the parts just behind, and near the abdominal ring; but it was easily separated. Govei does not mention whether the mother survived; but the thing would not be very astonishing, considering the situation of the fœtus. Bertrandi says he was unacquainted with any other example of the Cæsarean Operation being done in cases of extra-uterine fœtuses, so as to save both the mother and infant. This eminent man condemned operating, in ventral cases, on the ground that the placenta could not be separated from the viscera, to which it might adhere, or, if left behind, it could not be detached, without such inflammation and suppuration as would be mortal. But if, in addition to such objections, says Bertrandi, the operation has been proposed by many, and practised by none, we may conclude, that this depends on the difficulty of judging of such pregnancies, and of the time when the operation should be attempted. He puts out of the question the dilatations, which have been indicated for extracting dead portions of the fœtus, and also Govei's case, who operated without expecting to meet with a fœtus at all. (*Bertrandi Traité des Opérations de Chirurgie*, Chap. 5.)

Whenever the Cæsarean Operation, or gastrotomy, has been performed, the practitioner is not merely to endeavour to prevent inflammation, heal the wound, and appease any untoward symptoms, which may arise; he should also prevail upon the mother to suckle the child, in order that the lochia may not be too copious, and, after the wound is healed, she should be advised to wear a bandage, for the purpose of hindering the formation of a ventral hernia, of which, according to surgical writers, there is a considerable risk.

Fr. Roussetus; *Cæsarei Partus Assertio Historiologica*, &c. 8vo. Paris, 1590. Fr. Roussetus, *Fœtus vivi ex matre viva sine alterutro periculo Cæsura*. 12mo. Basil. 1591. Theoph. Raynaud, *De Ortu Infantium contra Naturam per Sectionem Cæsaream*, &c. 12mo. Lugd. 1637. A. Cyprianus, *Epistola*

Historiam exhibens Fetus humani post 21 menses ex uteri tuba, matre salva, ac superstitie, excisi. 8vo. Lugd. Bat. 1700. This is the celebrated case related by Albosius at the end of Bauhin's *Transl. of Rousset. J. B. Verduc; Traité des Opérations de Chirurgie; nouvelle Edit.* 12mo. Par. 1721. Sabatier's *Médecine Opératoire, T. 1, Ed. 2. Recherches sur l'Opération Césarienne par M. Simon, in Mém. de l'Acad. Royale de Chirurgie, Tom. 3, p. 210, &c. and Tom. 5, p. 317, &c. Edit. in 12mo. Bertrandi Traité des Opérations de Chirurgie, Chap. 5. Boudeloque's Traité des Accouchemens, Paris, 1807. Denman's Introduction to Midwifery, 4to. 1805. Also Obs. on the Rupture of the Uterus, &c. 8vo. 1810. Hull's Defence of the Cæsarean Operation, 8vo. Manchester, 1798. Also his Letters to Mr. W. Simmonds. Haighton's Inquiry concerning the true and spurious Cæsarian Operation. P. Berten, De Sectione Sigaultiana et Cæsarea harumque Sectionum inter se Comparatione: (Coll. Diss. Lorain. 4, 321.) G. Ruellan, Quæstio, &c. An ad servandam pro fetu matrem, obstetricum hamatilis minus anceps et æque insons, quam ad servandum cum matre factum sectio Cæsarea. (Haller, Disp. Chir. 3, 525. Paris, 1744.) A. Lindemann, De Partu Preternaturali quem sine Matris aut Fetus Sectione absolute non licet. 4to. Gott. 1755. Med. Obs. and Inquiries, Vol. 4, p. 274, &c. J. Vaughan, Cases, &c. to which is annexed an Account of the Cæsarean Section, &c. 8vo. Lond. 1778. P. J. F. Walckiers, de Hysterotomotica, sine Sectione Cæsarea, Lovan. 1785. Edinb. Med. and Surgical Journ. Vol. 4, p. 178, Vol. 8, p. 11. Garthshore's Obs. on Extra-uterine Cases, inserted in the 8th Vol. Lond. Med. Journ. Richter's Anfangsgr. der Wundarzneykunst, B. 7, Kap. 5; Gott. 1804. C. Bell in Medico-Chirurg. Trans. Vol. 4, p. 347, &c.; J. J. Locher, Vol. 9; and J. J. Locher, N. Meyer, F. Spitzbarth, & J. Lorinser; in Vol. 11 of the same work. J. F. Freymann, De Partu Cæsareo. 12mo. Marb. Catt. 1797. G. Josephi, über die Schwangerschaft ausserhalb der Gebärmutter, &c. 8vo. Rostock, 1803. Flajani Osservazioni, &c. di Chirurgia, T. p. 3, 144, &c. Roma, 1802. Rhode, Relatio de Sectione Cæsarea feliciter peracta. 4to. Dorpat, 1803. K. Sprengel, Geschichte der Chir. Th. 1, p. 369, &c. 8vo. Halle, 1805. M. Baudeloque, Two Memoirs on the Cæsarean Operation. Transl. with notes, &c. by John Hull. 8vo. Manchester, 1811. E. L. Heim, Erfahrungen, &c. über Schwangerschaften ausserhalb der Gebärmutter, 8vo. Berlin, 1812. A. J. A. Stevens, De Conditionibus quæ apud parturientem Sectionem Cæsaream, vel potius illam Synchrononeos ossium Pubis, postulant. 4to. Lugd. 1817. Dictionnaire des Sciences Med. T. 17, p. 419, Paris, 1816, and T. 23, p. 293, &c.; 1818. F. Von Siebold, Journal für Geburtshülfe, Frauenzimmer und Kinderkrankheiten, 3 B. 8vo. Francof. 1819.*

CALCULUS. Calculi form in the ducts of the salivary glands; in the kidneys, bladder, urethra, gall-bladder, &c. A paper on calculi formed in the lachrymal sac,

has just been published in Graefe's new Journal. (*Journ. für die Chir. No. 1, Berlin, 1820.*) For an account of what are commonly called stones in the bladder, refer to *Urinary Calculi.*

CALCULUS IN THE INTERIOR OF THE EYE. See *Eye, &c.*

CALLUS, New bone, or the substance which serves to join together the ends of a fracture, and for the restoration of destroyed portions of bone.

1. The old surgeons believed callus to be a mere inorganic concrete, a fluid poured out from the extremities of the ruptured vessels, which was soon hardened into bone. They always described it as an "exudation of the bony juice, and imagined that it oozed from the ends of broken bones, as gum from trees, sometimes too profusely, sometimes too sparingly. The reunion of broken bones, and the hardening of callus, they compared with the gluing together of two pieces of wood, or the soldering of a broken pot. (*A. Paré.*) The old surgeons also conceived, that callus sometimes flowed into the joints, so as to form a clumsy, prominent protuberance.— They imagined that callus was a juice, which congealed at a determinate period of time, and they therefore had fixed days for undoing the bandages of each particular fracture. They supposed that its exuberance might be suppressed by a firm and well-rolled bandage, and its knobby deformities corrected by pillows and compresses; that it might be softened by frictions and oils, so as to allow the bone to be set anew. All their notions were mechanical; and their absurd doctrines have been the apology for all the contrivers of machines, from Hildanus down to Dr. Aitken and Mr. Gooch.

2. By Galen and Duhamel, however, a second doctrine was entertained, which imputed the formation of callus altogether to the periosteum and medullary texture, which were supposed to produce two solid rings round the fracture, the interspace between them being afterwards effaced.

3. A third opinion, maintained by Bordenave, and the best modern observers, is, that the process of nature, in the production of callus, bears a great resemblance to the changes which take place for the reunion of wounds of the soft parts.

A bone is a well-organized part of the living body; that matter, which keeps its earthy parts together, is of a gelatinous nature. The phosphate of lime, to which a bone owes its firmness, is deposited in the interstices of the gluten, undergoing a continual change and renovation. It is incessantly taken up by the absorbents, and secreted again by the arteries. It is this continual absorption and deposition of earthy matter, which forms the bone at first, and enables it to grow with the growth of the body. It is this unceasing activity of the vessels of a bone which enables it to renew itself when it is broken or diseased. In short, it is by various forms of one secre-

ting process; that bone is formed at first, is supported during health, and is renewed on all necessary occasions. Bone is a secretion, originally deposited by the arteries of the bone, which arteries are continually employed in renewing it. Callus is not a concrete juice, deposited merely for filling up the interstices betwixt fractured bones, but it is a regeneration of new and perfect bone, furnished with arteries, veins, and absorbents, by which its earthy matter is continually changed, like that of the contiguous bone. Indeed, there could be no connexion between the original bone and callus, were the latter only the inorganic concrete, which it was formerly supposed to be.

Notwithstanding the more accurate opinions now entertained, concerning callus, the supposition is still very common, that the slightest motion will destroy a callus, which is about to form. But, says Mr. John Bell, it is an ignorant fear, proceeding merely from the state of the parts not having been observed; for, when callus forms, the perfect constitution of the bone is restored; the arteries pour out from each end of a broken bone a gelatinous matter; the vessels, by which that gluten is secreted, expand and multiply in it, till they form, betwixt the broken ends, a well-organized and animated mass, ready to begin anew the secretion of bone. Thus, the ends of the bone, when the bony secretion commences, are nearly in the same condition, as soft parts which have recently adhered; and it is only when there is a want of continuity in the vessels, or when a want of energetic action incapacitates them from renewing their secretion, that callus is imperfectly formed. This is the reason, why in scorbutic constitutions, in patients infected with syphilis, in pregnancy, in fever, or in any great disorder of the system, or while the wound of a compound fracture is open, no callus is generated. (*John Bell's Principles of Surgery, Vol. 1, p. 500, 501.*) How far some of the latter statement is correct, or not, will be seen in the article *Fractures*.

For some time, the secretion of earthy matter is imperfect; the young bone is soft, flexible, and of an organization suited for all the purposes of bone; but, hitherto delicate and unconfirmed; not a mere concrete, like a crystallization of a salt, which, if interrupted in the moment of forming, will never form; not liable to be discomposed by a slight accident, nor to be entirely destroyed by being even roughly moved or shaken. Incipient callus is soft, fleshy, and yielding; it is ligamentous in its consistence, so that it is not very easily injured; and, in its organization, it is so perfect, that when it is hurt, or the bony secretion interrupted, the breach soon heals, just as soft parts adhere, and thus the callus becomes again entire, and the process is immediately renewed.

In consequence of the above circumstances, if a limb be broken a second time,

when the first fracture is nearly cured, the bone unites more easily than after the first accident; and Mr. J. Bell even asserts, that when it is broken a third, and a fourth time, the union is still quicker. In these cases, the limb yields, it bends under the weight of the body, which it cannot support; but, without any snapping or splintering of the bone, and, generally, without any overshooting of the ends of the part, and without any crepitation.

Callus is found to be more vascular, than the old bone. Mr. John Bell mentions an instance of a bone, which had been broken twelve years before he injected it, yet the callus was rendered singularly red. When a recently formed callus is broken, many of its vessels are ruptured, but some are only elongated, and it rarely happens that its whole substance is torn. It is easy to conceive, how readily the continuity of the vessels will be renewed in a broken callus, when we reflect on its great vascularity; and the vigorous circulation, excited by the accident in vessels already accustomed to the secretion of bone. These reasons show, why a broken or bent callus, is more speedily united, than a fractured bone.

When bones granulate, says Mr. Wilson, the granulations at first appear exactly similar to those of the soft parts, and, as in the soft parts, take place to restore any loss, which the bones may have suffered. This process is very similar to that of the first formation of bone. In the skull, membrane was first formed; and here also, in the process of restoration, the granulations change into membrane, and then into bone. In cylindrical bones, the granulations first produce a species of cartilage, and this is afterwards converted into bone. Thus, in the restoration of bone, nature is guided by the same laws, which prevail in its first formation. If the granulations, thrown out on the surface of a bone, be viewed in a microscope, they appear to form a number of small points, like villi, the bases of which first become similar to cartilage, and then to bone. "The preparations from the surface of granulating stumps, show the extreme delicacy of the first bony threads, and also their mode of uniting laterally with each other." (*J. Wilson's Lectures on the Structure, Physiology, and Diseases of the Bones, &c. p. 197, 8vo. Lond. 1820.*)

And, in another place, he repeats, "I have examined several skulls on the death of the persons. at different periods, from days to years after pieces of bone had been removed, and before the vacancies had been completely filled up; but, I never could, in any of them, discover the least appearance of cartilage." A membrane here always precedes the formation of bone. (p. 210.) For additional observations on callus, see *Fracture. N. M. Muller, De Callo Ossium; 4to. Norimb. 1707; Duhamel in Mém. de l'Acad. Royale des Sciences an. 1741. p. 92, et 222; Boehmer, de Callo Ossium è rubia tinctorum radicks pastu infectorum, 4to. Lips. 1752; Dethleef, Diss. exhibens Ossium Calli.*

generationem et naturam per fracta in animalibus rubra radice pastis ossa demonstratam, 4to. Goett. 1753; *A. Marrigues, sur la Formation du Cal*. Paris, 1783. *A. M'Donald, De Necrosi, &c.* Edin. 1799. *The works of Troja, David, Blumenbuch, and Koehler, as specified at the conclusion of the article Necrosis*. *J. Wilson, Lectures on the Structure, Physiology, and Diseases of the Bones*, p. 208, 8vo. &c. Lond. 1820.

CALOMEL. (Submuriate of mercury; hydrargyri submuriatis. L. P.) Its extensive utility, in numerous surgical diseases, will be conspicuous in a large proportion of the articles in this work. When prescribed, as an alterative, the common dose is a grain once or twice a day; when ordered as a purgative, from three to eight grains may be given, and when directed, with the view of exciting salivation, one or two grains, conjoined with opium, are usually administered night and morning. This medicine, combined with opium, is frequently given, for the relief of what is usually termed *spasmodic stricture*, which is an attendant on severe cases of gonorrhœa.

CALX CUM POTASSA. This is a strong kind of caustic, chiefly used for making the eschars, when issues are formed in cases of diseased vertebrae, white swellings, morbid hip-joints, &c. (See *Vertebrae*.) This caustic is also sometimes used, though not so often as it was formerly, for opening buboes and other abscesses. Some are in the habit of making it into a paste with soft soap; they cover the part affected with adhesive plaster, in which there is a hole of the size of the eschar intended to be made; and into this aperture they press the paste till it touches the skin. A bandage is then applied to secure the caustic substance in its situation, till the intended effect is produced.

The action of calx cum potassa, in this way, however, is more inert and tedious, and, perhaps, on this account, more painful. Hence, many of the best modern surgeons never adopt this method; but, after covering the surrounding parts with sticking plaster, rub the caustic on the situation, where it is desired to produce an eschar, till the skin turns brown. The end of the caustic must first be a little moistened.

The calx cum potassa, is sometimes employed also for destroying fungous excrescences.

Before the port-wine injection was found to answer best for the radical cure of hydrocele, this caustic was often used as a means of cure. (See *Hydrocele*.) Mr. Else, a chief advocate for the latter method, used to mix the caustic with powdered opium, by which contrivance, it is said, though not with much appearance of truth, that the sloughs were made with little, or no pain to the patient.

Some assert that the potassa alone, acts more quickly, than when mixed with quicklime. I have not found this to be the fact, and, after trying both, give the preference to the calx cum potassa.

CAMPHOR, is used externally, chiefly as a means of exciting the action of the absorbents, and thus dispersing many kinds of swellings, extravasations, indurations, &c. Hence, it is a common ingredient in liniments. It has also the property of rousing the action of the nerves, and quickening the circulation in parts, on which it is rubbed. For this reason, in paralytic affections, it is sometimes employed. Perhaps, there is no composition, that has greater power in exciting the absorption of any tumour, or hardness, than camphorated mercurial ointment.

In cases of delirium, depending on the irritation of local surgical diseases, and in some descriptions of mortification, camphor is occasionally prescribed. It has also been recommended, as singularly useful for the relief of stranguries, even those depending on the operation of cantharides. But, although it may occasionally have succeeded, when given with this view, it not only does not always do so, but, it has been known to cause an opposite effect, sometimes producing great scalding in voiding the urine, and sometimes pains like those of labour. (*Medical Transactions*, Vol. 1, p. 470.) In chordee, its utility is generally acknowledged.

CANCER. (derived from *cancer*, a crab, to which, a part, affected with cancer, and surrounded with varicose veins, was anciently thought to have some resemblance.) *Carcinoma*.

The disease has two principal forms; one named *scirrhus*, or *occult cancer*; the other, *ulcerated*, or *open cancer*. According to the usual definition, as Mr. Pearson observes, an indolent scirrhus is a hard and almost insensible tumour, commonly situated in a glandular part, and accompanied with little, or no discolouration of the surface of the skin. But, when the disease has proceeded from the indolent to the *malignant* state, the tumour is unequal in its figure, it becomes painful, the skin acquires a purple, or livid hue, and the cutaneous veins are often varicose. (*Principles of Surgery*, § 331, 343.) The pain is remarked to be acute and lancinating, and its attacks recur with more or less frequency. At length, the tumour breaks, and is converted into cancer, strictly so called, or the disease in the state of ulceration.

The female breast, and the uterus, are particularly subject to the disease. The breasts of men are but rarely affected. The testes, lips, (especially the lower one of male subjects) the penis, the lachrymal gland and eye, the tongue, the skin, (particularly that of the face) the tonsils, the pylorus, the bladder, rectum, prostate, and a variety of other parts, are recorded by surgical writers as having frequently been the seat of scirrhus and cancer. They seem, however, to have comprehended an immense number of different malignant diseases under one common name, and, in many of the cases called cancerous, there are no vestiges of the true scirrhus structure.

OF SCIRRHUS, OR CANCER, NOT IN THE UL-
CERATED STATE.

Mr. Abernethy has given a matchless history of this affection, as it appears in the female breast, where it most frequently occurs, and can be best investigated. Sometimes, says this valuable writer, it condenses the surrounding substance, so as to acquire a capsule; and then it appears, like many sarcomatous tumours, to be a part of new formation. In other cases, the mammary gland seems to be the nidus for the diseased action. In the latter case, the boundaries of the disease cannot be accurately ascertained, as the carcinomatous structure, having no distinguishable investment, is confused with the rest of the gland. Sir Everard Home also remarks, that when the disease originates by a small portion of the glandular structure of the breast becoming hard, which is very commonly the case, it is readily distinguished by the hard part never having been perfectly circumscribed, and giving more the feel of a knot in the gland itself, than of a substance distinct from it. In each of these instances, carcinoma begins at a small spot, and extends from it in all directions, like rays from a centre. This is one feature distinguishing this disease from many others, which, at their first attack, involve a considerable portion, if not the whole, of the part, in which they occur. The progress of carcinoma is more or less quick in different instances. When slow, it is in general unremitting. Mr. Abernethy thinks, that though the disease may be checked, it cannot be made to recede by the treatment, which lessens other swellings. On this point, however, he is not positive; for, surgeons have informed him, that diseases, which eventually proved to be carcinomatous, have been considerably diminished by local treatment. With great deference to Mr. Abernethy, we may be allowed to remark in this place, that every tumour, which ends in cancer, is not from the first of this nature, though it has in the end become so; consequently, it may at first yield to local applications, but will not do so after the cancerous action has commenced. Hence, Mr. Abernethy's opinion, that a true carcinomatous tumour cannot be partially dispersed, at least, remains unweakened by the fact, that some tumours have at first been lessened by remedies, though they at last ended in cancer. Sir E. Home's observations tend to prove, that any sort of tumour may ultimately become cancerous.

Without risk of inaccuracy, we may set down the backwardness of a scirrhus swelling to be dispersed, or diminished, as one of its most confirmed features. This obdurate and destructive disease excites the contiguous parts, whatever their nature may be, to enter into the same diseased action. The skin, the cellular substance, the muscles, and the periosteum, all become affected, if they are in the vicinity of cancer. This very striking circumstance distinguishes carcinoma, says Mr. Aber-

nethy, from several other diseases. In what this author calls *medullary sarcoma*, the disease is propagated along the absorbing system; but the parts immediately in contact with the enlarged glands do not assume the same diseased actions. Neither in the *tuberculated* species does the ulceration spread along the skin, but destroys that part only which covers the diseased glands. According to Mr. Abernethy, a disposition to cancer existing in the surrounding parts, before the actual occurrence of the diseased action, was a circumstance noticed by Mr. Hunter. Hence arose the following rule in practice: *That a surgeon ought not to be contented with removing merely the indurated, or actually diseased part, but that he should also take away some portion of the surrounding substance, in which a diseased disposition may probably have been excited.* In consequence of this communication of disease to the contiguous parts, the skin soon becomes indurated, and attached to a carcinomatous tumour, which, in like manner, is fixed to the muscles, or other part, over which it was formed.

As a carcinomatous tumour increases, it generally, though not constantly, becomes unequal upon its surface, so that this inequality has been considered as characteristic of the disease. A lancinating pain is common; but it is not experienced in every case, without exception. It is also a symptom, attending other tumours, which are unlike carcinoma in structure, and it cannot, therefore, be deemed an infallible criterion of the nature of the disease. (*Abernethy's Surgical Works, Vol. 2, p. 69, &c.*)

A hard and painful glandular swelling, having a disposition to become cancer, says Richter, is the common but, inadequate and erroneous definition of scirrhus. The disease is not regularly attended with swelling; sometimes scirrhus parts diminish in size and shrink. Hardness is not a characteristic property; for many tumours, which are not scirrhus, are exceedingly indurated. The disease is not always situated in the gland: it frequently attacks structures, which cannot be called glandular; and hard glandular swellings are often seen, which do not partake of scirrhus. The disposition to cancer cannot be enumerated among the marks of scirrhus, since it is not discoverable, till carcinoma has actually commenced. Its termination in open cancer, is not an invariable occurrence; and other tumours become cancerous, to which no one would apply the term scirrhus. (*Anfangsgr. der Wundarzn. B. 1.*)

Scientific surgeons ought undoubtedly to have a definite meaning when they employ the term scirrhus; the word is generally used most vaguely; and, perhaps, influenced by its etymology, surgeons call an immense number of various morbid indurations scirrhus, which are not at all of a malignant or dangerous character.

I have always considered scirrhus as a diseased hardness, in which there is a propensity to cancerous ulceration, and a

greater backwardness to recede, than exists in any other kind of diseased hardness, although the skin may occasionally not break during life, and a few scirrhus indurations may have been lessened.

Though Richter states, that this disposition cannot be discovered, till carcinoma has actually taken place; though Mr. J. Burns and Sir E. Home confirm, that other indurations and tumours may terminate in cancer; though Mr. Abernethy shows, that sarcomatous and encysted tumours may end in most malignant diseases, and such as from their severity merit the name of cancer; (*Chir. Works*, p. 83.) yet, it is now well ascertained, that, in all these instances, the changes, which precede cancerous ulceration, bear no resemblance to those of a true malignant scirrhus.

The puckering of the skin, the dull leaden colour of the integuments, the knotted and uneven feel of the disease, the occasional darting pains in the part, its fixed attachment to the skin above, and muscles beneath, form so striking an assemblage of symptoms, that, when they are all present, there cannot be the smallest doubt, that the tumour is a scirrhus, and that the disease is about to acquire, if it have not already acquired, the power of contaminating the surrounding parts, and the lymphatic glands, to which the absorbents of the diseased part tends.

As Sir Everard Home has observed, the truly scirrhus tumour, which is known to be capable of changing into the true open cancer, when allowed to increase in size is known to be hard, heavy, and connected with the gland of the breast; and, when moved, the whole gland moves along with it. The structure of a scirrhus tumour in the breast, is different in the various stages of the disease; and a description of the appearances, exhibited in the three principal ones, may give a tolerable idea of what the changes are, which it goes through, previous to its breaking, or becoming, what is termed, an open cancer.

When a section is made of such a tumour, in an early stage, provided the structure can be seen to advantage, it puts on the following appearance: the centre is more compact, harder to the feel, and has a more uniform texture, than the rest of the tumour; and is nearly of the consistence of cartilage. This middle part does not exceed the size of a silver penny; and from this, in every direction, like rays, are seen ligamentous bands, of a white colour, and very narrow, looking, in the section, like so many extremely irregular lines, passing to the circumference of the tumour, which is blended with the substance of the surrounding gland. In the interstices, between these bands, the substance is different, and becomes less compact towards the outer edge. On a more minute examination, transverse ligamentous bands of a fainter appearance, form a kind of network, in the meshes of which the new-formed substance is enclosed. This structure accords with what Dr. Baillie describes

to be the case in cancerous diseases of the stomach and uterus.

In a more advanced stage of the tumour, the whole of the diseased part has a more uniform structure; no central point can be distinguished; the external edge is more defined, and distinct from the surrounding gland; and the ligamentous bands, in different directions, are very apparent, but do not follow any course, that can be traced.

When the tumour has advanced to what may be called cancerous suppuration, which, however, does not always happen in the centre, before it has approached the skin, and formed an external sore; it then exhibits an appearance totally different from what has been described. In the centre is a small irregular cavity, filled with a bloody fluid, the edges of which are ulcerated, jagged, and spongy. Beyond these there is a radiated appearance of ligamentous bands, diverging towards the circumference; but the tumour near the circumference is more compact, and is made up of distinct portions, each of which has a centre, surrounded by ligamentous bands, in concentric circles.

In some instances, scirrhus has no appearance of suppuration, or ulceration; in the centre, but consists of a cyst, filled with a transparent fluid, and a fungous excrescence, projecting into this cavity, the lining of which is smooth and polished.—When a large hydatid of this kind occurs, a number of very small ones have been found, in different parts of the same tumour; and, in other cases, there are many very small ones, of the size of pins' heads, without a large one. These hydatids are, by no means, sufficiently frequent in their occurrence to admit of their forming any part of the character of a cancerous tumour.—(*Home's Observations on Cancer*, p. 156, &c. 8vo. Lond. 1805.)

In the fourth chapter of this work, the author relates two cases of hydatids found in the breast. In the first, the contents of the cyst were bloody serum; in the second, a clear fluid. These two cases of simple hydatids in the breast, unconnected with any other diseased alteration of structure, led Sir E. Home to consider more particularly the nature of such hydatids, as are sometimes found in cancerous breasts; and, he believes, that they form no real part of the cancerous disease, but are accidental complaints superadded to it; and it is this gentleman's belief, that, as they occur in the natural state of the gland, they are much more likely to do so in disease, (*Op. cit.* p. 108, 159.)

Sir E. Home defines what he means by cancer, as follows: "As cancer is a term too indiscriminately applied to many local diseases for which we have no remedy, though they differ very much among themselves, it becomes necessary to state what the complaints are which I include under this denomination. The present observations respecting cancer, apply only to those diseased appearances, which are capable of

contaminating other parts, either by direct communication, or through the medium of the absorbents; and when they approach the skin, produce in it small tumours of their own nature, by a mode of contamination, with which we are at present unacquainted.

"There is a disease, by which parts of a glandular structure are very frequently attacked, particularly the os tincae, the alae of the nose, the lips, and the glans penis. This has been called cancer, but differs from the species, of which we are now treating, in not contaminating the neighbouring parts with which it is in contact; and neither affecting the absorbent glands, nor the skin at a distance from it. It is, properly speaking, an eating sore, which is uniformly progressive; whereas, in cancer, after the sore has made some progress, a ridge is formed upon the margin, and the ulceration no longer takes that direction. It also differs from a cancer, in admitting of a cure in many instances, and under different modes of treatment.

"From the facts which have been stated. (*See the cases detailed in this gentleman's work*;) it appears that cancer is a disease which is local in its origin. In this respect the cases (alluded to) only confirm an opinion very generally received among medical practitioners; but, in favour of which no series of facts had been laid before the public, of sufficient force entirely to establish the opinion." (P. 145, &c.)

Sir E. Home endeavours to establish a second point, that cancer is not a disease which immediately takes place in a healthy part of the body; but one, for the production of which it is necessary, that the part should have undergone some previous change, connected with the disease. In proof of this, Sir E. Home adduces the two first cases in his work, and the innumerable instances in which a pimple, small tumour, or wart upon the nose, cheek or prepuce, may remain for ten, fifteen, or thirty years, without producing the smallest inconvenience; but, at the age of sixty or seventy, upon being cut in shaving, bruised by any accidental violence, or otherwise injured, assumes a cancerous disposition.

All the cases of induration of the gland of the breast, or of indolent tumours in it, which have continued for years without producing any symptom, and, after being irritated by accidental violence, have assumed a new disposition, and become cancerous, admit of the same explanation; and are adduced as so many proofs of the truth of this latter position. (P. 147, &c.)

However, the doctrine that certain tumours may change their nature, and change into cancer, is one which is sometimes looked upon with suspicion. "Improper treatment may without doubt exasperate diseases, and render a complaint, which appeared to be mild and tractable, dangerous or destructive; but, to aggravate the symptoms, and to change the form of the disease, are things, that ought not to be

confounded. I do not affirm (says Mr. Pearson) that a breast, which has been the seat of a mammary abscess, or a gland that has been affected by scrofula, may not become cancerous; for they might have suffered from this disease, had no previous complaint existed; but, these morbid alterations generate no greater propensity to cancer, than if the parts had always retained their natural condition. There is no necessary connexion between cancer and any other disease; nor has it ever been clearly proved, that one is convertible into the other." (*Pract. Obs. on Cancerous Complaints*, p. 8.) To the latter way of thinking, Mr. Abernethy also inclines; for, in speaking of the occurrence of cancer in parts previously diseased in another manner, he confesses, that his own observations have not led him to believe, that this change is common. "Cases of tumours, which have remained indolent for twenty or more years, becoming cancerous at an advanced period of life, are not unfrequently met with;" but, (says Mr. Abernethy,) the patients "might have been liable to the formation of a cancerous disease, even if no diseased structure had previously existed." A degree of indecision, however, appears to be thrown upon this statement by the admission, that cancer is more likely to begin in parts previously diseased. (*Surg. Works*, Vol. 2, on Tumours, p. 87.)

The following are some of the most distinguishing characters of scirrhus. A scirrhous induration seldom acquires the magnitude, to which almost all other tumours are liable to grow, when no steps are taken to retard their growth. Many scirrhi are attended even with a diminution, or shrunk state, of the part affected.

Scirrhi are generally more fixed, and less moveable, than other sorts of tumours; especially, when the latter have never been in a state of inflammation.

With the exception of the fungus hæmatoides, other diseases do not involve in their ravages indiscriminately every kind of structure, skin, muscle, cellular substance, &c. and the integuments seldom become affected. Before the distention, produced by the size of such swellings, becomes very considerable. In scirrhous cases, the skin soon becomes contaminated, discoloured, and puckered.

Some few tumours may be harder, and heavier, than a few scirrhi; but, the reverse, is commonly the case.

As other indurations, and tumours, may assume the cancerous action, and even end in cancerous ulceration; and, as some true scirrhi, when not irritated by improper treatment, may continue stationary for years; the occurrence of actual carcinoma cannot prove, that the preceding state was that of scirrhus. The only criterion of the latter disease is deduced from the assemblage of characters already specified; for, except the peculiar puckering, and speedy leaden discolouration of the skin, no other appear-

ances, considered separately, form any line of discrimination.

The white ligamentous bands, around a scirrhus, form a very characteristic mark of the complaint, at least as it presents itself in the female breast; but, these cannot be detected, till the disease has been removed. Hence, how manifestly prudent it must be to take away a considerable portion of the substance surrounding a scirrhus tumour! Were any of these white bands left, the disease would inevitably recur.

Mr. Pearson has never yet met with an unequivocal proof of a primary scirrhus in an absorbent gland, and, (says he) "if a larger experience shall confirm this observation, and establish it, as a general rule, it will afford material assistance in forming the diagnosis of this disease. (*Pract. Obs. on Cancerous Complaints*, p. 5.) Sir E. Home, however, has given the particulars of one case, which seemed to him to have commenced in one of the lymphatic glands, situated between the nipple and the axilla. (*Obs. on Cancer*, p. 161.) The position laid down by Mr. Pearson, that when the disease originates in those glands, it will rarely be found to be of a cancerous nature, may yet be very generally correct.

OF CANCER IN THE STATE OF ULCERATION.

According to the observations of Mr. Abernethy, the diseased skin, covering a carcinomatous tumour of the breast, generally ulcerates, before the swelling has attained any great magnitude; a large chasm is then produced in its substance, partly by a sloughing, and partly by an ulcerating process. Sometimes, when cells, contained in the tumour, are by this means laid open, their contents, which are a pulpy matter of different degrees of consistence, and various colours, fall out, and an excreting ichor issues from their sides. This discharge takes place with a celerity, which would almost induce belief, that it can hardly result from the process of secretion. When the diseased actions have, as it were, exhausted themselves, an attempt at reparation appears to take place, similar to that which occurs in healthy parts. New flesh is formed, constituting a fungus of peculiar hardness, as it partakes of the diseased actions, by which it was produced. This diseased fungus occasionally even cicatrizes. But, though the actions of the disease are thus mitigated; though they may be for some time indolent and stationary; they never cease, nor does the part ever become healthy.

In the mean while, the disease extends through the medium of the absorbing vessels. Their glands become affected, at a considerable distance from the original tumour. The progress of carcinoma in an absorbent gland, is the same as that, which has been already described. The disease is communicated from one gland to another, so that after all the axillary glands are affected, those which lie under the collar

bone, at the lower part of the neck, and upper part of the chest, become disordered. Occasionally, a gland, or two, become diseased higher up in the neck, and apparently out of the course which the absorbed fluids would take. As the disease continues, the absorbent glands, in the course of the internal mammary vessels, become affected. In the advanced stage of carcinoma, a number of small tumours, similar in structure to the original disease, form at some distance, so as to make a kind of irregular circle round it.

The strongest constitutions now sink under the pain and irritation, which the disease creates, aggravated by the obstruction, which it occasions to the function of absorption, in those parts, to which the vessels leading to the diseased glands belong. Towards the conclusion of the disease, the patient is generally affected with difficulty of breathing, and a cough. (See *Abernethy's Surgical Works*, Vol. 2, p. 72, &c.)

In the above species of carcinoma, described by Mr. Abernethy, the part is peculiarly hard, and rarely attains considerable magnitude. He admits, however, that there are varieties, and speaks of another case, in which the integuments sometimes remain pale and pliant; "and a surgeon, who first sees the breast in this state, may doubt whether the disease be actual cancer, or common sarcoma. The substance of the tumour is also much less hard, than in the specimen first described; yet, it is more compact and weighty, than most other diseases of the same bulk, which are not carcinomatous. If the history of the disease accords with that of carcinoma; that is to say, if it began in a small district, and regularly and unabatingly attained its present magnitude; if the surface of the tumour be unequal, having produced in various parts roundish projecting knobs, the disease will almost invariably be found to be carcinoma. The skin will soon adhere to one, or more of these prominences; it will ulcerate and expose the subjacent parts; and the future progress of the disease will accord to that of the harder and smaller specimen," except that the absorbents are much less liable to be affected. (*Vol. cit.* 85.)

The edges of a cancerous ulcer are hard, ragged, and unequal, very painful, and reversed in different ways, being sometimes turned upwards and backwards, and, on other occasions inwards. The whole surface of the sore is commonly unequal: in some parts, there are considerable risings, whilst, in others, there are deep excavations. The discharge, for the most part, is a thin, dark coloured, fetid ichor; and is often possessed of such a degree of acrimony, as to excoriate, and even destroy, the neighbouring parts. In the more advanced stages of the disease, a good deal of blood is often lost from the ulcerated vessels. A burning heat is universally felt over the ulcerated surface; and, this is the most tormenting symptom, that attends the disorder. Those shooting, lancinating pains, which

are generally very distressing in the occult state of the complaint, became now a great deal more so. Notwithstanding cancerous diseases are not always situated in glandular parts, the situation of such sores affords some assistance in the diagnosis; for, six times as many cancerous affections occur in the lips, and female breasts, as in all the rest of the body together. (B. Bell.)

By some of the old writers, the causes of cancer were referred to the presence of worms, which destroyed the parts, and produced all the local mischief. Strange as this doctrine may appear, one very analogous to it was adopted by the late Dr. Adams. (*Observations on Morbid Poisons.*) When hydatids found their way into a solid substance, he supposed, that the effect would be cancer; and he conjectured, that the success of an operation would depend, in a great measure, upon these animals being confined in a common cyst, for then they could be entirely removed; whereas, if they were unconnected, some of the smaller ones would be likely to remain. The absurdity of this doctrine, and the eccentric reasoning, by which it is supported, make it quite unnecessary here to fatigue the reader with an explanation of it. Concerning the manner, in which these animals produce the symptoms of cancer, we are told, that "this enlargement of a foreign body in a solid substance, and so extremely sensible, as the breast, cannot but be attended with intense pain, and frequent inflammation:" a doctrine not far removed, says Mr. J. Burns, from that taught in the humoral schools, which maintained, that the coagulation, and inspissation of the fluids, distended the follicles of the glands, producing many cavities, and much pain. (J. Burns on Inflammation, Vol. 2.) Though hydatids are occasionally found in cancerous tumours, they are not found often enough to make any part of the character of the disease; and they are met with in cases in which there is not the least vestige of such disorder.

After cancer had continued some time, it was believed, that the matter was absorbed into the blood, and that all the humours were speedily assimilated. Hence was explained the fatal and rapid progress of relapses, after an apparent cure. The only effect of absorption, however, is on the lymphatic glands, which intervene betwixt the sore and the heart; for, beyond these, the absorbed matter is changed in its nature and properties. (Burns.)

In many instances, cancer is evidently produced by the same causes, which are capable of producing simple inflammation. It is, however, a general opinion, that cancer arises frequently from some unknown and mysterious cause, which we cannot detect, and which, therefore, has been resolved into a constitutional taint. But, as far as we know, the constitution is perfectly healthy in the commencement of this disease; nor is there the smallest proof, that it resembles scrofula, in depending on any

peculiarity of constitution, before the causes operate. Blows, bruises, &c. may give rise to cancer; but, in many instances, there is no evident local cause acting directly on the part. In the breast, cancer frequently commences, without the interference of any topical agent. In these cases, however, there is always an irregularity, or disappearance of the menses; and the affection of the mamma may be supposed to depend on sympathy between it and the uterus. Certain it is, that cancer is very frequent about the time of life, when the menstrual discharge ceases.

It is a commonly received opinion, that cancer is an hereditary disease, or observed to prevail a good deal in particular families. Sir Everard Home has endeavoured to reconcile this sentiment to the doctrine of the disease being at first entirely of a local nature; circumstances, which seem incompatible: "It is now universally admitted (says he) that children take after their parents in the general structure of their bodies, and therefore will be more or less liable to have the different solids, of which they are composed, disturbed by the same causes; and when a violence of any kind is committed upon them, it may be productive of the same diseases.—In some families, the venereal disease shall always appear in the form of gonorrhœa [?]; in others again, rarely or never in that form, but, in that of chancre. [?] Strictures in the urethra are common in some families: they have taken place in a father, and all his sons from very slight causes; such indeed as would not have produced the disease in others. Yet, stricture cannot be called hereditary, because it is a local complaint, arising from a local inflammation differing in different people, according to the natural irritability of the parts, which are affected. In this way, and this only, can cancer run in families, and be an hereditary disease, &c." (*Obs. on Cancer*, p. 156.) The observations, which this gentleman has published respecting cancer, are unquestionably some of the most valuable which have yet been collected; but, I am doubtful about the correctness of one term, which is frequently met with in his work, viz. *cancerous poison*. At all events, I am not at present acquainted with any facts, which satisfactorily demonstrate the existence of such virus; and, from some circumstances briefly mentioned in vol. I of the 4th edition of the *First Lines of the Practice of Surgery*, the reality of a poison of this nature would seem at least questionable. In support of the belief in the existence of a cancerous virus, it has been observed, however, "that we scarcely ever see glands diseased out of the course, which the absorbed matter would naturally take, though they are affected in this manner in diseases, which can be propagated by irritation." (*Abernethy's Surg. Works*, Vol. 2, on Tumours, p. 75.)

Undoubtedly, cancer is most common in elderly persons; but no age is exempt from the disease. Mr. J. Burns has seen it dis-

tinely marked, and attended with a fatal event, in children of five years old; he mentions two instances of the eye being affected in such subjects, though from the late observations of Mr. Wardrop, we may now reasonably suspect, that these examples were really cases of the fungus hæmatodes. An instance, in which a cancerous disease of the breast began at the age of fifteen, is related by Sir E. Home. (*Obs. on Cancer, &c. p. 50.*)

TREATMENT OF CANCER.

Cancers have sometimes been supposed to be a general disorder of the system; sometimes merely local affections. This is a point of much importance in practice; for, if cancers are originally only local affections, no objection can be made to extirpating them. They who think, that cancer is a constitutional disease, regard the operation as useless, perhaps hurtful, inasmuch as it may convert a scirrhus into an open cancer, or make the affection occur in some other part.

Some of the best practitioners of the present day, however, reject the doctrine of cancer depending on constitutional causes; and, we have stated Sir E. Home's sentiments, in opposition to the opinion. When cancer breaks out again, in the same part, after the performance of an operation, it is often owing to some portion of the disease having been blameably left behind, or to the operation having been put off too long. How likely it is, that some of the cancerous disease may be left unremoved by the operator, is obvious on considering the manner, in which the white bands, resembling ligament, shoot into the surrounding fat; and that, even the fibres of the muscles, beneath a cancerous disease, are frequently affected. At the same time, it must be allowed, that the disease is sometimes, to all appearances, so freely and completely removed, that its recurrence may be imputed, perhaps with equal probability, to the continued operation of the same unknown cause, which originally produced the first cancerous mischief.

Until late years, the accounts given of the results of operations for cancers were so unpromising, that they deterred many patients from undergoing a timely operation; which, for cancerous complaints, is the only remedy to be depended on, with which we are as yet acquainted. As Mr. B. Bell remarks, the great authority of Dr. Alexander Monro must have had no inconsiderable influence even with practitioners, in making them much more backward in undertaking the extirpation of cancers, than they otherwise would have been. "Of near sixty cancers," says he, "which I have been present at the extirpation of, only four patients remained free of the disease, at the end of two years: three of these lucky people had occult cancers in the breast, and the fourth had an ulcerated cancer on the lip." (*Edinb. Med. Essays, Vol. 5.*) Dr. Monro also observes, that, in

those, in whom he saw the disease relapse, it was always more violent, and made a quicker progress, than it commonly did in others, on whom no operation had been performed. Hence he questions, "whether ought cancerous tumours to be extirpated, or ought the palliative method only to be followed?" and, upon the whole, he concludes against their extirpation, except in such as are of the occult kind, in young healthy people, and have been occasioned by bruises, or other external causes.

More modern experience, however, has afforded a very different result, and given ample encouragement to the early performance of an operation, and even to making an attempt to cut away the disease, in every instance, both of the occult and ulcerated kind, when such a measure can be so executed, as not to leave a particle of the cancerous mischief behind.

Mr. Hill, in 1772, published some valuable remarks on the present subject. At this period, he had extirpated from different parts of the body eighty-eight genuine cancers, which were all ulcerated, except four; and all the patients, except two, recovered of the operation. Of the first forty-five cases, only one proved unsuccessful; in three more, the cancer broke out again in different parts; and, in a fifth, there were threatenings of some tumours, at a distance from the original disease. These tumours, however, did not appear, till three years after the operation; and the woman was carried off by a fever, before they had made any progress. All the rest of the forty-five continued well, as long as they lived: or are so, says Mr. Hill, at this day. One of them survived the operation above thirty years; and, fifteen were then alive, although the last of them was cured in March, 1761.

Of the next thirty-three, one lived only four months; and, in five more, the disease broke out afresh, after having been once healed. The reason why, out of forty-five cases, only four or five proved unsuccessful, and six, out of thirty-three, was as follows: "The extraordinary success I met with, (says Mr. Hill,) made cancerous patients resort to me from all corners of the country, several of whom, after delaying till there was little probability of a cure by extirpation, or any other means, forced me to perform the operation, contrary both to my judgment and inclination."

Upon a survey in April, 1764, made with a view to publication, the numbers stood thus: Total cured, of different ages from eighty downwards, sixty-three; of whom there were then living thirty-nine. In twenty-eight of that number, the operation had been performed more than two years before; and, in eleven, it had been done in the course of the last two years. So that, upon the whole, after thirty years' practice, thirty-nine, of sixty-three patients, were alive and sound; which gives Mr. Hill occasion to observe, that the different patients lived as long after the extirpation of the cancers, as according to the bills of morta-

lity, they would have done, had they never had any cancers, or undergone any operation.

The remaining twenty-five, which complete the eighty-eight, were cured since the year 1764. Twenty-two of these had been cured, at least, two years; and some of them, it may be remarked, were seventy, and one ninety years old.

In the year 1770, the sum of the whole stood thus: Of eighty-eight cancers, extirpated at least two years before; not cured, two; broke out afresh, nine; threatened with a relapse, one; in all, twelve, which is less than a seventh part of the whole number. At that time, there were about forty patients alive and sound, whose cancers had been extirpated above two years before.

Mr. B. Bell, who was present at many of these cases, bears witness to Mr. Hill's accuracy; and the former very judiciously states, that, "from these and many other authenticated facts, which, if necessary, might be adduced, of the success attending the extirpation of cancers, there is, it is presumed, very great reason, for considering the disease, in general, as a local complaint, not originally connected with any disorder of the system." With respect to Mr. Bell's opinion, that a general cancerous taint seldom, or perhaps never, occurs, but in consequence of the cancerous virus being absorbed into the constitution from some local affection, much doubt attends even this supposition, though the practical inference from it is what cannot be found fault with: viz. in every case of real cancer, or rather in such scirrhusities, as from their nature, are known generally to terminate in cancer, we should have recourse to extirpation as early as possible; "and if this were done soon after the appearance of such affections, or before the formation of matter takes place, their return would probably be a very rare occurrence." (*System of Surgery*, Vol. 7.)

After comparing the different accounts of success given by Mohro and Hill, well might Richter say: "*Jure sane dixeris, de uno eodemque morbo hos viros loqui, dubitari fere potest.*" (*Obs. Chir. Fasc. 3.*)

MEDICINES AND PLANS, WHICH HAVE BEEN TRIED FOR THE CURE OF SCIRRHUS AND CANCER.

It is a contested point, whether a truly cancerous disease is susceptible of any process, by which a spontaneous cure can be effected. It appears certain, however, that a violent inflammation, ending in sloughing, may sometimes accomplish an entire separation of a cancerous affection, and that the sore, left behind, may then heal. Facts, confirming this observation, are occasionally exemplified in cases, where caustic is used, and accidental inflammations have led to the same fortunate result, as we may be convinced of by examples recorded by Sir Everard Home, Richerand, &c. The latter writer, adverting to the effort, which nature sometimes makes to rid herself

of the disease, on the inflammation and bursting of the tumour, takes the opportunity to relate the following case. A woman, aged forty-eight, of a strong constitution, was admitted into the hospital of St. Louis, with a cancerous tumour of the right breast. The swelling, after becoming softer, and affected with lancinating pains, was attacked with an inflammation, which extended to the skin of the part, and all the adjacent cellular membrane. The whole of the swelling mortified, and was detached. A large sore, of healthy appearance, remained after this loss of substance, and healed in two months. (*Nosographie Chir. T. 1, p. 381, Edit. 2.*)

In general, however, it must be confessed, that inflammation, attacking a cancerous disease, renders things worse instead of better, and by converting occult cancers into ulcerated ones, hastens the patient's death, or, at all events, renders his cure more difficult, and forbids any attempts, which, on such a principle, might be made for his relief.

Of the general remedies, narcotics, such as cicuta, opium, nightshade, &c. have been employed with most confidence.

Cicuta owed its reputation to the experimenting talent of Storck, who has written several libelli on this plant. According to him, cicuta possesses very evident powers over cancer, and has cured a great many cases; but, in less prejudiced hands, it has been found much less successful; and even in many of the instances, adduced by Baron Storck, of its utility, it is by no means proved, that the disease was really cancer. The public have now, with great reason, very little reliance on this medicine. Mr. J. Burns declares, that, in cancerous ulceration, he never knew cicuta to produce even temporary melioration.

The common way of exhibiting hemlock is to begin with small doses, and increase them gradually, until they produce vertigo. We may begin with two grains of the extract, or four of the powder, recently prepared, twice, or thrice a day, and the quantity is to be gradually increased. In this way, some patients have at last been able to take an ounce of the extract daily; but, says Mr. Burns, if a much less quantity, than this, produce no good effect, we may consider it as useless to continue a remedy, which, in this dose, must injure the constitution every day that it is continued. On the continent, hemlock has been used in the form of a bath; but, this method is so disagreeable, that few will submit to it.

Belladonna was highly recommended by Lambergen. During its use, he kept the bowels open with clysters, administered every second day. The dose should be, at first, a grain of the dried leaves, made into a pill. This, in the beginning, is to be given in the morning and evening, and afterwards more frequently. The reputation of belladonna has not been supported by much success.

Hyosciamus has often been tried in can-

cerous cases, and was held in great estimation by the ancients. Mr. J. Burns says, he has employed it occasionally, but with little effect. The common dose at first is three grains of the extract.

Aconitum has also been given; and, as it is a very powerful and dangerous narcotic, a patient usually begins with only half of a grain of the extract night and morning. *Solanum dulcamara*, *Paris quadrifolia*, *phytolacca*, &c. have been recommended; but, they are now hardly ever employed; which is a sufficient proof of their inefficacy. Mr. J. Burns tried the hydro-sulphuret of ammonia, without any benefit. Richter prescribed the *laurus cerasus*, but with very little success. The dose of the distilled water being uncertain, four or five grains of the fresh leaves may be infused in a little water, as a dose.

The *digitalis* diminishes vascular action, and may act on scirrhi, like abstinence, bleeding, &c. It has, however, no specific virtue in curing cancerous diseases.

Opium is seldom employed, with an intention of curing cancer, although it probably has just as much power of this kind, as other narcotics, which have been more frequently used. For the purpose of lessening the pain of cancerous diseases, opium is very freely employed.

Tonics may sometimes improve the general health; but, as they never produce any effect on the local disease, they are now seldom exhibited.

Justamond thought arsenic a specific for cancers. Future experience has not, however, confirmed the truth of this opinion, though there are many practitioners, who continue to think highly of the efficacy of this mineral in certain forms of disease, which have sometimes been classed with cancer, and in many cases of lupus, and malignant ulcers of the tongue, and other parts, it may really possess greater claims to further trial, than perhaps any other medicine, yet suggested. It unquestionably cures numerous ill-looking sores, on the face, lips, and tongue, and is one of the best remedies for lupus. Mr. Hill observes: "Experience has furnished me with some substantial reasons for considering arsenic as a medicine of considerable merit, both with regard to actual cancer and scirrhus, which may one day terminate in that horrible species of ulcer; and although I cannot as yet say it will remove the one, or cure the other, as certainly and safely as mercury commonly does a syphilitic swelling, or open sore, yet, it will, in a great majority of cases, retard the progress of the true scirrhus tumour, and often prevent its becoming cancer. In some, it has appeared, to dissipate such swellings completely." (*See Edinb. Med. and Surgical Journ. Vol. 6. p. 58.*)

Mercury, in conjunction with decoctions of *guaiacum*, *sarsaparilla*, &c. has been recommended; but, as Mr. J. Burns remarks, no fact is more certainly ascertained, than that mercury always exasperates the dis-

ease, especially, when in the ulcerated state.

Sulphate of copper has been tried; but, at present, it retains no character, as a remedy for cancer. The same may be said of muriated barytes.

The carbonate (rust) of iron was particularly recommended by Mr. Carmichael. Besides the carbonate of iron, he sometimes prescribed the tartrate of iron and potass, and the phosphate, oxyphosphate, and suboxyphosphate of the metal. Some constitutions can bear these preparations only in small quantities; they affect most patients with constipation, and many with headach and dyspnea. These circumstances, therefore, must be attended to in regulating the dose. The above gentleman has seldom given less than thirty grains, in divided doses, in a day, or exceeded sixty. He prefers the suboxyphosphate for internal use, and states, that it answers best in small doses, frequently repeated. It should be blended with white of egg, have a little pure fixed alkali added, and then be made into pills with powdered liquorice. Aloes is recommended for the removal of costiveness. When half a grain is combined with a pill, containing four grains of carbonate of iron, and taken thrice a day, the constipation will be obviated. When the internal use of iron brings on headach, difficult respiration, a quick, sometimes full pulse, which is also generally hard and wiry, excessive languor, lassitude, &c. and such symptoms become alarming, the iron is to be left off, and four grains of camphor given every fifth hour.

At the same time, that preparations of iron were internally administered, Mr. Carmichael employed externally, for ulcerated cancers, the carbonate, phosphate, oxyphosphate, and arseniate of iron, blended with water, to the consistence of a thin paste, which was applied once every twenty-four hours. To occult cancers, the same gentleman applied a solution of the sulphate of iron, \mathfrak{zj} to lbj of water. The acetate of iron, diluted with eight or ten times its weight of water, was also used. These lotions were put on the part affected by means of folded linen, wet in them, and covered with a piece of oiled silk to prevent injury of the clothes. (*See An Essay on the effects of the Carbonate and other preparations of iron upon Cancer, &c. by R. Carmichael, 2d Ed. 8vo. Dublin, 1808.*)

Many remedies have acquired celebrity in cases of cancer, because very bad and malignant diseases, only supposed to be cancers, have got well, under their use. Such is probably the case with the carbonate of iron.

The only mode of treatment, which Mr. Pearson has ever seen to do any particular benefit to cancer, is that of keeping the patient on a diet, barely sufficient for the support of life, such as barley-water alone, tea, &c. Patients, with cancers, receive considerable benefit from being kept strictly on a milk diet.

The old surgeons commonly dressed can-

cerous sores, with narcotic applications. Vesalius used cloths, dipped in the juice of the solanum; whilst others employed it mixed with oil of roses, and preparations of lead, and antimony. Others had recourse to the hyosciamus; but, of late, cicuta poultices have superseded most other narcotic applications; and, in many cases, as Mr. J. Burns observes, they have undoubtedly abated pain, and diminished fetor; but this is all which can reasonably be expected; and even this expectation will not always be realized. This gentleman thinks carrot poultices better than those of hemlock, as they produce as much ease, and more powerfully diminish the fetor.

The fetor of cancers having been thought to resemble that of the sulphuret of potash, (liver of sulphur) and the oxygenated muriatic acid being the best agent for decomposing and destroying such smell, it has been recommended, as an application to cancerous sores. It may correct the fetor; but, it will never accomplish a cure. Carbonic acid has been said not only to correct the fetor, but, in some instances, completely to cure the disease. It was long ago proposed, says Mr. J. Burns, by Peyrille, and was again brought forward by Dr. Ewart. Experience, however, has not shown, that the efficacy of carbonic acid, in cases of cancer, is very great. Fourcroy remarks: "After the first applications, the cancerous sore appears to assume a more favourable aspect; the sanies, which flows from it, becomes whiter, thicker, and purer, and the flesh has a redder and fresher colour; but, these flattering appearances are deceitful, nor do they continue long, for the sore speedily returns to its former state, and its progress goes on, as before the application." The best method of applying carbonic acid is, by means of a bladder, the mouth of which is fastened round the sore with adhesive plaster. The air is introduced by a pipe, inserted at the other end.

Sometimes the fermenting poultice is employed.

Digitalis, as a local application, is entitled to about as much confidence as cicuta.

Tar ointment, gastric juice, absorbent powders, &c. have been tried; but, without any evident good. (See *J. Burns on Inflammation*, Vol. 2.)

Mr. Fearon rejected all internal remedies, as inefficient in the treatment of cancer, and in the early stages of the complaint, recommended a method of practice, founded on his idea of the inflammatory nature of the disease. "In the beginning of scirrhus affections of the breast and testis, the mode I have adopted of taking away blood, is by leeches repeatedly applied to the parts. In this course, however, I have often been interrupted by the topical inflammation, produced by these animals, around the parts where they fastened. In delicate female habits, I have often lost a week, before I could proceed to the re-application of them. When the symptoms lead me to suspect the

stomach, uterus, or any of the viscera, to be so affected, that the complaint either is, or, most probably, soon will become cancerous, I then have recourse to general bleedings. But, whether topical or general, perseverance for a sufficient length of time is necessary. Though the pulse never indicated such practice, yet the patients have not suffered by repeated bleedings; on the contrary, when they passed a certain time without losing blood, they felt a return of their symptoms, and of their own accord, desired to be bled again. To this plan of repeated bleedings, I joined a milk and vegetable diet, avoiding wine, spirits, and fermented liquors." Mr. Fearon used also to keep the belly open, and employ saturnine applications.

Of the method of treating cancer by pressure, I have spoken in another work. (*First Lines of the Practice of Surgery*, Vol. 1.) and therefore, in this place, I need merely repeat, that it is a practice, which none of the best modern surgeons think entitled to approbation.

From the preceding accounts, we may infer, that scarcely any reliance is to be placed on any known remedy, or plan, in cases of real scirrhi, and ulcerated cancers.

The operation is the only rational means of getting rid of the disease; and, to waste time, so as to allow the disorder to increase in a serious degree, merely for the sake of trying a train of unpromising medicines, is conduct, which is unworthy of a wise surgeon's imitation.

Perhaps, in early cases, it may be right to make trial of arsenic, cicuta, or preparations of iron. But, the practitioner should beware of devoting too much time to medicines, which will in all probability prove inadequate to the object for which they are exhibited. Mr. Fearon's method seems also warrantable, together with diet merely enough to support life; but the punishment, attending a resignation to this last regimen, would be greater, than that of having the disease cut away, while the chance of efficacy would be much less. Upon the whole, therefore, the operation is what we should generally adopt, as the surest, and the safest means of getting rid of cancerous diseases. As I have before remarked, the operation is always admissible, when every particle of the disease can be removed by it. Even large open cancers, if they can be entirely cut away, are often capable of being effectually cured.

The removal of cancerous disorders even in the slightest and most trivial cases, should always be effected with the scalpel, in preference to caustic; the use of which, though sometimes it may succeed by producing a complete destruction of the diseased parts, causes severe agony, and, in the event of its not acting sufficiently on all the diseased parts, often renders the complaint more aggravated, and kills the patient, and this in a very short space of time.

In cases of cancer, the irritation generally

occasioned by every application of the caustic kind, together with the pain and inflammation, which commonly ensue, are strong objections. Plunket's remedy, which is chiefly arsenic, is equally objectionable. Nor can you, at once, so certainly extirpate every atom of cancerous mischief with any caustic, as you can with the knife: for, with this, you immediately gain an ocular inspection of the surface surrounding the disease, so as to see and feel whether the disordered parts are completely removed, or whether any portion of the disorder requires a further employment of the instrument. With respect to the pain, that of caustics is infinitely greater, more intolerable, and more tedious, than that occasioned by the knife. When caustic also fails in destroying every particle of the disease at once, it almost always tends to enlarge, in a very rapid way, the original boundaries of the mischief. For an account of the method of removing scirrhi and ulcerated cancers, see *Mamma, Removal of*. Much additional information, respecting cancers, is contained in the 4th Ed. of the *First Lines of the Practice of Surgery*, Vol. 1, 8vo. 1819. *Le Dran's Operations in Surgery*, p. 87, &c. Edit. 2. *B. Bell's Surgery*, Vol. 2. *Justamond's Account of the Methods pursued in the Treatment of Cancerous and Scirrhus Disorders*, 8vo. Lond. 1780; also his *Surgical Tracts*, &c. 8vo. Lond. 1789. *James Hill, Cases in Surgery*, 8vo. Edinb. 1772. *Vindungus ab Harting, De Optima Cancrum Mammarum extirpandi ratione*. Alsdorf, 1720. (*Haller, Disp. Chir.* 2, 509.) *L. Rouppe, de Morbis Navigantium liber, accedit Obs. de Effectu, Extraculi cicutæ Storkiano in Cancro* 8vo. Lugd. 1764. *G. Dowman, on the Nature, &c. of a Scirrhus*, 8vo. Lond. *A. Storck, An Essay on the Medical Nature of Hemlock*, &c. 8vo. Lond. 1760. *C. Molinarius Historia Mulieris a scirrho curatæ*, 8vo. Vindob. 1761. *G. Tabor, De Cancro Mammarum, cumque nova extirpandi Methodo, Trajecti*, 1721. *C. Perry, Mechanical Account of the Hysteric Passion, &c. with an Appendix on Cancer*, 8vo. Lond. 1755. *Sir John Hill, plain and useful Directions for those who are afflicted with Cancers*, 2d. Ed. 8vo. Lond. *G. A. Langguth, Programma de potissimis Canceri Mammarum Causis prudenter occupandis*, Wiltemb. 1752. *Ph. Fr. Gmelin et Achat. Gärtner, Specifica Methodo recentior cancerum sanandis*, &c. Tubingæ, 1757. *N. Zaffarini, Storia di due Mammelle demolite nella di cui scirroso sostanza sono stati trovati nove Aghi*. 8vo. Venez. 1761. *C. Petrus, Diss. sistens historiam rariorem mammæ cancræ, sanguinem menstruum fundentis, methodo simpliciore sanatæ*.—(*Frankl. Del. Op.* 10.) *W. Beckett, New Discoveries, relating to the Cure of Cancers, wherein a method of dissolving cancerous substance is recommended*, &c. 8vo. Lond. 1711. *W. Norford, Essay on the general Method of treating Cancerous Tumours*, &c. 12mo. Lond. 1753. *R. Guy, An Essay on Scirrhus Tumours and Cancers*, 8vo. Lond. 1759; also, *Practical Obs. on Cancers*, &c. 8vo. J.

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CANCER SCROTI.—**CHIMNEY-SWEEPER'S CANCER.** (See *Scrotum*.)

CANCRUM ORIS. A deep, foul, irregular, fetid ulcer, with jagged edges which appears upon the inside of the lips and cheeks, and is attended with a copious flow of offensive saliva. According to Mr. Pearson, this disease is seldom seen in adults; but, most commonly, in children from the age of eighteen months to that of six or seven years. The gums, as well as the lips and cheeks, are sometimes affected, in which circumstance, the teeth are generally carious and loose. The ulceration is occasionally attended with abscesses, which burst either through the cheek, lip, or just below the jaw. Exfoliations are not unfrequent, and, when the disease is neglected, extensive sloughing sometimes happens.

Living in a marshy situation; unwholesome food; and inattention to cleanliness; are suspected to be conducive to this disorder. The causes of the affliction seem not to be understood; but it is remarked, that the disease prevails most in houses, where children are crowded together. It is uncertain whether the complaint is contagious.

Though children are the usual subjects of this disease, grown-up persons do not always escape its attacks.

The treatment recommended consists in extracting diseased teeth and loose pieces of bone, directing a milk vegetable diet, with a prudent quantity of fermented liquors; and prescribing bark, sarsaparilla, and elm bark, with sulphuric acid.

The best external applications are, diluted mineral acids; burnt alum; the decoction of cinchona, with sulphate of zinc; tincture of myrrh; lime-water, with spirit of wine, &c. (See *Pearson's Principles of Surgery, Edit. 2, p. 287.*)

CANTHARIDES. (*Lytæ*.) Spanish or French flies, with which the common blistering-plaster is made. In surgery, they are also prescribed in incontinence of urine, gleet, &c. The tincture is sometimes used as a liniment for stimulating parts.

CAPELINA. (from *capeline*, a woman's hat, or bandage, French.) A double-headed roller, above twenty-four feet long, and four inches broad. The middle is applied to the occiput, and, after two or three circular rounds, the rollers intersect each other upon the forehead and occiput; then one roller being reflected over the vertex to the forehead, the other is continued in a circular track. They next cross each other upon the forehead, after which the first head is carried back obliquely towards the occiput, and reflected by the side of the other.

The last is continued in a circular direction; but the first is brought again over the sagittal suture, backward and forward, and so continued, till the whole head is covered.

By the ancients, this bandage was some-

times applied in cases of hydrocephalus: it has no advantage, however, and is now hardly ever used.

CAPILLARY FISSURE. A very minute crack in the skull. The term came into use from the resemblance of such a fracture to a hair.

CAPISTRUM. (See *Bandage*.)

*** CARBUNCLE.** (from *carbo*, a burning coal.) *Anthrax.* This is a very common symptom in the plague; but comes on also sometimes as a primary disease. The first symptoms are great heat and violent pain in some part of the body, on which arises a kind of pimple, attended with great itching; below which a circumscribed, but very deep-seated, and extremely hard tumour may be felt with the fingers. This tumour soon assumes a dark red, or purple colour, about the centre, but is considerably paler towards the edges. A blister frequently appears on the apex, which, as it occasions an intolerable itching, is often scratched by the patient. The blister being thus broken, a brown sanies is discharged, and an eschar makes its appearance. Many such pimples are sometimes produced upon one tumour, in consequence of the patient's scratching the part. (*Bromfield's Obs. Vol. 1.*)

Carbuncles have been distinguished into the *benign* and *malignant* kinds; but as far as the disease can be judged of at present in this country, the distinctions are only founded upon the different degrees of violence, with which the disease makes its attack. Some carbuncles are said to be *pestilential*; while others are not at all infectious. Fortunately, all cases, which are met with in this island are of the last sort; for no opportunities of remarking the pestilential anthrax have occurred in England since the deplorable periods of 1665, and 1666.

The carbuncle sometimes appears in persons affected with typhoid fevers, in which case, it is attended with great weight and stiffness of the adjacent parts; the patient is restless and pale, the tongue white, or of a deep red, and moist; the pulse low, urine sometimes pale, sometimes very turbid, with all the other symptoms in an exaggerated degree, which attend typhoid fevers. The patient often complains much of his head, either from pain or giddiness. Sometimes he is drowsy; at other times, he cannot get the least sleep. Occasionally, he is delirious. The case is also apt to be attended with chilliness, or rigours, and profuse perspirations. The patient is sometimes costive, sometimes afflicted with a profusion of stools; he generally complains of loss of appetite, nausea, and vomiting, takes but little nourishment, complains of difficulty of breathing, and is extremely low, with palpitations of the heart, and sometimes faintings. (See *Bromfield's Observations, Vol. 1, p. 122.*)

Sometimes a little slough, of a black colour, appears in the middle of the tumour. This was supposed by the ancients to be a part of the body burnt to a cinder, or hard crust, by the violence of the disease. By some authors, the carbuncle is considered

as a sort of gangrenous affection of the cellular substance. (*Latta*.) The progress of carbuncles to the gangrenous state is generally quick. Their size is very various; they have been known to be as large as a plate. Considerable local pain and induration always attend the disease. The skin, indeed, has a peculiar feel, like that of brawn. As the complaint advances, several apertures generally form in the tumour. Through these openings, there is discharged a greenish, bloody, fetid, irritating matter. The internal sloughing is often very extensive, even when no sign of mortification can be outwardly discovered.

If attention is paid to the skin in this case, we shall frequently find some miliary eruptions about the clavicles, the breasts, or other parts of the body; and, towards the latter end of the disorder, a different collection of large pimples will sometimes be thrown out, like the small-pox, and suppurate. Some of these, indeed, are occasionally converted into actual carbuncles. It was this species of anthrax, which was called *malignant*, and certainly, if any cases, seen in this country, demand this epithet more strongly than others, it is the instance, the description of which we have just quitted.

The constitution is often so low and exhausted, that death follows. The carbuncle, indeed, is most frequent in old persons, whose constitutions have been injured by voluptuous living, and, hence, we cannot be surprised, that the local disease, influenced by the general disorder of the system, should assume a dangerous aspect.

The degree of peril may generally be estimated by the magnitude and situation of the tumour, the number of such swellings at the same time, the age of the patient, and the state of his constitution.

In cases of anthrax, the duty of a surgeon may be described in a few words.—With regard to the local treatment, the grand thing is to make an early, and free incision into the tumour, so as to allow the sloughs and matter to escape readily. As much of the contents as possible is to be at once pressed out, and then the part is to be covered with an emollient poultice. Indeed, until the tumour is opened, no applications are more proper than emollient poultices, and, when an incision has been made, they are far preferable to any detersive antiseptic injections, made with bark, tincture of myrrh, &c. or to any lotions made with the sulphates of copper, and zinc, nitrate of silver, &c.; fomentations will also be found to afford considerable relief, both before and after an opening has been made. As the discharge is exceedingly fetid and irritating, it will be necessary to put on a fresh poultice two or three times a day. The use of the poultice is to be continued till all the sloughs have separated, and the surface of the cavity appears red, and in a granulating state, when soft lint and a pledget of some unirritating ointment, should be applied, together with a compress and bandage. The manner in

which the disease is protracted, by not making a proper opening in due time, cannot be too strongly impressed upon the mind of every practitioner, and it may justly be regarded as a frequent reason of the fatal terminations of numerous cases. Mr. Bromfield forcibly inculcates the necessity of making a timely opening for the discharge of the sloughs; for, says he, in case you rely on the opening, made by nature, the thin matter only will be discharged; the sloughy membranes will remain, and the orifice close up. (See *Vol. 1, p. 128.*)

It was formerly not an uncommon custom to extirpate carbuncles with the knife, or to destroy them with the actual and potential canteries. The French were very fond of burning the swelling with a hot iron, the employment of which is sanctioned by Porteau. (See his *Œuvres Posthumes*.) These methods, having been found cruelly painful, and, in no manner advantageous, have long been branded with the reproaches of all English surgeons. With respect to the constitutional treatment, we should remember that the disease is for the most part met with in bad constitutions, and in persons who are weak and irritable.—Hence, it is only when there is a full strong pulse, and the complaint is just beginning, that bleeding is allowable. Bark and camphor are the internal medicines most commonly needed. The diluted sulphuric acid is also highly proper, as well as wine and aromatics. As the pain is very severe, opium is generally an essential remedy.—The constitutional treatment is very analogous to that of mortification, and, for this reason, I do not deem it necessary to enlarge the present article, by expatiating on this part of the subject. (See *Mortification*.)

In many of the southern parts of Europe, a malignant species of carbuncle, appears to be endemic, contagious, and very often fatal. For an account of this form of the disease, I would particularly advise the reader to consult *Richerand's Nosogr. Chir. T. 1, p. cex, &c. Edil. 4, and Larrey's Mémoires de Chirurgie Militaire, Tom. 1, p. 104, &c.* A description of it was likewise introduced into the 4th edition of the *First Lines of Surgery*. Bromfield's *Chirurgical Cases and Observations, Vol. 1. L'Encyclopédie Méthodique, Partie Chirurg. art. Anthrax.* Pearson's *Principles.* Richter's *Anfangsgr. der Wundarzn.* B. I. Boyer's *Traité des Maladies Chirurgicales, T. 2, p. 50, &c.*

CARCINOMA. (from *καρκινος*, a crab.) See *Cancer*.

CARIES. (from *καίω*, to abrade.) Caries is a disease of the bones, supposed to be very analogous to ulceration of the soft parts; and this comparison is one of great antiquity, having been made by Galen. However, by the generality of the ancients, caries was not discriminated from necrosis.

It was from the surgeons of the eighteenth century, that more correct opinions were derived respecting caries. Until this period, writers had done little more, than mention the complaint and the methods of treating it. Some new light was thrown upon the

subject by J. L. Petit, in his remarks upon exostosis and caries. (*Mal. des Os. T. 2, Chap. 16, p. 27.*) But, as he only spoke of the disorder, as one of the terminations of exostosis, he has not entered far into the consideration of it. The best observations on caries were first made by Dr. A. Monro, *primus*. (*Edinb. Med. Essays, T. 5, art. 25.*) This memoir contains the earliest correct ideas of dry caries, or necrosis, which is rightly compared to mortification of the soft parts, and named *gangrenous caries*.

The bones, like other parts of the body, are composed of arteries, veins, absorbent vessels, nerves, and a cellular texture; they are endued with vitality; they are nourished, grow, waste, are repaired, and undergo various mutations, according to the age of the individual; and they are subject to diseases analogous to those of the soft parts. To the phosphate of lime, which is more or less abundantly distributed in their texture, they owe all their solidity, and, perhaps, it is to the same earthy substance, that the difference in their vital properties, and in their diseases, from those of the rest of the body, is to be referred. In fact, this particular organization, and inferior vitality of the bones, are generally supposed to account for the small number peculiar character, and slow progress of their diseases. (*Dict. des Sciences Med. T. 4, p. 80.*)

All the bones are liable to caries; but those of a spongy texture are more frequently attacked, than such as are compact. Hence, the vertebrae; astragalus, and other bones of the tarsus; those of the carpus; the sternum; the bones of the pelvis, and the heads of the long bones, are often affected; and the bones of young persons are unquestionably more frequently the seat of caries, than those of old subjects.

In necrosis, the bone is entirely deprived of life; in caries, the vital principle exists, but a morbid action is going on, whereby the texture of the bone is altered, and rendered softer and lighter than natural.

In the most common species of caries, a loose, fungous flesh grows out of the interstices, formed on the surface of the diseased bone, and bleeds from the slightest causes. There is generally a sinus in the soft parts, which leads down to the caries, and emits a very fetid, dark-coloured sanies. These symptoms, however, as well as the tendency in the accompanying ulcer or sinus, to produce large fungous granulations, are more constant in cases of necrosis, than in those of caries, some of which may remain a very considerable time unattended with any outward sore, abscess, or sinus, as we see illustrated in the caries produced by various diseases of the joints. And, indeed, particular forms of caries, (if they deserve that name) are rarely accompanied with suppuration: a fact, to which I shall again advert.

"The absorption of bone, like that of soft parts (says Dr. Thomson,) may be distinguished into interstitial, progressive, and ulcerative. We have ample proofs of the interstitial absorption, or that which is daily,

hourly, and unceasingly taking place from every part of the substance of bone, in the deposition and removal of phosphate of lime, that has been tinged with madder. If too much earth be removed, the quantity of animal matter will be relatively increased, and a disposition given to softness of the bones—a state, which exists in the bones of children in the disease called the rickets, and in the bones of older people in that denominated mollities ossium, or the rickets of grown people.

"I have already had occasion to mention the effects of the progressive absorption of bone, as manifested in the progress of aneurisms and other tumours to the skin; but, the formation of pus is by no means a necessary, constant, or even frequent attendant on the progress of progressive absorption in bone. Hydatids in the brains of sheep, tumours growing from the pia or dura mater in the human body (see *Dura Mater*), or aneurism seated over the cranium, or within the cavity of the chest, are often the cause of the whole substance of a bone being removed, layer after layer, by progressive absorption, without the formation of a single particle of pus. (See *Aneurism*.) This state of the bone has often been confounded, but improperly, with that state of the bone, which arises from ulcerative absorption, the state, which is properly denominated caries, and in which, one or more solutions of continuity may be produced upon the surface, or in the substance of the bones. The ulcerations occasioned in bones by the venereal disease, afford by far the best marked examples of the effects and appearances of ulcerative absorption, or caries in bones, &c." (See *Thomson's Lectures on Inflammation, p. 389.*)

Caries has been divided into three kinds, according to the nature of its causes: 1, Caries from external causes; 2, from an internal local cause, where no outward injury of the bone, and no internal constitutional disease, can be suspected to have produced the disorder, and where the affection can be removed by local means. The caries of the finger bones from whitlows, is quoted as a specimen of this form of the disease. Perhaps, however, the case is generally rather an instance of necrosis; 3, from a general internal cause, or constitutional disease, in which cases, besides local remedies, it is necessary to employ such medicines, as are calculated to obviate the particular affection of the system, whence the diseased state of the bone has originated.

But, in addition to these general divisions of the subject, there are many circumstances, in relation to the varieties of caries, which may be said yet to lie in obscurity. If, as a modern writer remarks, the situation of the bones, the nature of their organization, and the slowness of their diseases, would let an attentive observer trace the formation, development, and progress of caries, no doubt, there would be noticed a diversity in its symptoms, corresponding to its different species; and, probably, it

would be found, that a venereal, or scrophulous caries would vary in its origin and progress, as much from a caries, from a purely local cause, as a venereal or scrophulous ulcer differs from the kind of ulceration, which follows a common abscess. (*Dict. des Sciences Méd. T. 4, p. 84.*) The *worm-eaten caries*, as it has been termed, which penetrates the whole substance of a bone, and gives it an appearance as if it had been bored in hundreds of places, is a very different affection from some other forms of the disease, whether superficial, or extended to the deeper texture of the bone affected.

Abscesses situated in the vicinity of bones, are frequently thought to be the cause both of necrosis and caries. Hence, the rule to open such abscesses at an early period, in order to prevent the bone from being affected. If some abscesses, like those which form over the anterior surface of the tibia, and mastoid process of the temporal bone, be frequently attended either with caries or necrosis, the latter is mostly the cause, and not the effect of the suppuration. Pus, which is a bland, unctuous, inodorous fluid, never attacks the soft parts, with which it is in contact, until its qualities are changed by exposure to the air. When an abscess forms in the anterior part of the parietes of the abdomen, the peritoneum of that part, naturally a thin membrane, instead of being destroyed, becomes thick and strong enough to resist the extension of the abscess towards the cavity of the abdomen. So also, when an abscess is formed over a bone, not originally diseased, or hurt by the same causes, which produced the abscess, and not injured by being kept exposed, or by astringent escharotic applications, neither caries, nor necrosis, is likely to happen. On the contrary, the periosteum, like the peritoneum, becomes thickened, and granulations are formed over it.

The venereal disease is sometimes a cause of caries; sometimes of necrosis; and in other instances, of exostosis. When it attacks the bones of the nose, it generally renders them carious, and the face sadly disfigured. The bones of the palate are sometimes altered in the same manner; but, on other occasions, the effect is necrosis.

In cases of cancer of the breast, the sternum and ribs are sometimes found carious. I believe, that, in such cases, the disease of the bones has nothing in its own nature, entitling it to be regarded as cancerous. It is a mere effect of the original disorder, and if the carious bone could be removed together with every particle of the disease of the soft parts, a cure would probably follow. Or, supposing the carious bone were the only portion of the disease left, it is conceivable, that the case might yet end in a cure.

Caries, arising from syphilis, most commonly affects the tibia, cranium, ossa nasi, ossa palati, and sternum.

A caries of the vertebræ is known by pe-

culiar symptoms, among which a paralysis of the inferior extremities, and lumbar abscesses, are the most remarkable.

Caries from an external, or from a local internal cause, is less dangerous than that, which proceeds from a constitutional disease, particularly, when the latter is difficult of cure.

A caries of the spongy part of bones is more difficult to cure, than a similar affection of their compact parts. Caries of the carpal and tarsal bones is particularly obstinate. These bones being in close contact, the affection cannot easily be prevented from spreading from one to the other. Amputation is often the only means of cure. The same is frequently the case, when the spongy heads of the long bones forming the large joints, become carious: Even this mode of relief is not practicable when the head of the bone lies very deeply, like that of the os femoris.

Caries of the ossa ilium, is also observed to be particularly difficult of removal.

Caries from scrophula is more difficult of cure, than that from syphilis, and scurvy; for, some efficacious remedies against the latter diseases are known; but scrophula cannot be said to be within the reach of medicine. The prognosis is less favourable in old, than young subjects, and much depends on the extent of the disease, the patient's strength, and the state of the soft parts.

When caries arises from constitutional disease, internal remedies are of course indicated. Thus mercurial and sudorific medicines put a stop to caries from syphilis; while, vegetable diet, and acids, cure both the scurvy, and the caries dependent on it.

According to writers, the indications in the treatment of caries are; either to produce a change in the action of the diseased portion of bone, whereby it may regain a healthy state; or to destroy it altogether.

In the caries from constitutional causes, the first object seems to be brought about by the operation of such remedies as remove the original disease; and I should much doubt, whether, in these cases, any very active local treatment is necessary, or free from objection. Of course, this remark is meant to apply only to examples, in which we possess some medicine, or plan, which is known to be a tolerably sure remedy for the general disease. This is not the case in caries from scrophula, and here issues, blisters, and other local means are unquestionably advantageous. (See *Joints and Vertebræ*.) But, surgeons have proceeded further, and, not content with issues, blisters, fomentations, &c. as means for quickening the action of the diseased bone, they have commonly recommended applying directly upon it the strongest stimulants, as the tincture of aloes or myrrh, a solution of the argenti nitratum, or diluted muriatic acid.

For the destruction of caries, the actual and potential cauteries, and cutting instruments, have been employed.

On the continent, and particularly in France, they still adhere to the plan of touching carious parts of bones with the actual cautery, after bringing them fairly into view by the previous use of the knife. It is thought, that the burning iron acts, by changing the caries into a necrosis, irritating the subjacent sound parts, and exciting that action of the vessels: by which the dead or diseased part of the bones must be thrown off. Such is the doctrine inculcated by Boyer.

Mr. Hey succeeded in cutting away a carious part of the tibia. He began the operation by dissecting off the granulations of flesh, which had arisen from the bone, and then sawed out, by means of a circular headed saw, a wedge of the tibia, two inches in length. The removal of this portion brought into view a caries of the cancelli, almost as extensive as the piece already removed. With different trephines, suited to the breadth of the caries, Mr. Hey removed the diseased cancelli of the bone, quite through to the opposite lamella. As the caries extended in various directions, it was not possible to remove the whole of it with a trephine, without removing also a large portion of the sound part of the bone, which Mr. Hey wished to avoid. By the assistance, therefore, of a strong sharp-pointed knife, he pursued the caries in every direction, until every part was taken away, which had an unsound appearance. The wound was simply dressed with dry lint; the whole surface was speedily covered with good granulations; and a complete cure was obtained, without any exfoliation.

Mr. Hey concludes this subject, as follows: "I have treated some other cases of caries of the tibia in the same manner, and with equal success. Where the extent of the caries is not so great as to prevent a complete removal of the morbid part, this method is extremely useful, and far superior to the use of the potential or actual cautery.

"The trephine is not wanted, where the cancelli of the bone are not affected with the caries. The diseased parts of the lamella may be removed with gouges or small chisels. Granulations of flesh will then arise from the sound parts of the bone, and become united with the integuments, which ought to be preserved as far as is possible." (*Pract. Obs. on Surgery.*)

If surgeons are often censurable for inert measures in a variety of diseases, I believe, they cannot be blamed for the same kind of inactivity in the treatment of caries, where they run, perhaps, into the opposite extreme, and, too confident in their knowledge of the cause and nature of the disease, they often make themselves too officious, and rather disturb, than promote the salutary processes of nature. (See *J. L. Petit, Traité des Mal des Os. Paris, 1741. A. Monro, in Edinb. Med. Essays, Vol. 5. Weidmann de Necrosi Ossium, Francof. 1793. Callisen's Systema Chirurgiæ Hodiernæ, Vol. 1, p. 493. Boyer's Traité des Maladies-Chir. T. 3. p.*

453, et seq. Paris, 1814. Richerand's Nosogr. Chir. T. 3, p. 134, edit. 4. Paris, 1815. Dict. des Sciences Med. T. 4, p. 78, &c. J. Wilson on the Structure, Physiology, and Diseases of the Bones, &c. p. 263, 2vo. Lond. 1820. A good description of the different kinds of caries is yet a desideratum.)

CASTRATION. The operation of removing a testicle. For an account of the cases rendering this measure necessary, see *Testicle, Diseases of*. The manner of operating is as follows: The patient being laid on a table of convenient height, the integuments covering the spermatic vessels in the groin, are to be divided. This incision should begin as nearly as possible, opposite to the opening in the abdominal muscle, and should be continued a good way down the scrotum.

The manner of beginning this incision is differently described by writers; some of them advising that the skin be held up by an assistant; others that the knife be used perpendicularly in this as in other parts. The latter mode is generally preferred by English surgeons. The length of the division is a more important consideration. A small wound will indeed serve to lay bare the spermatic chord; but it will not permit the operator to do what is necessary afterwards with dexterity, or facility; and as the scrotum must, first or last, be divided nearly to the bottom, it had better be done at first. The spermatic chord, thus laid bare, is to be freed from its surrounding membranous connexions; and then the operator, with his finger and thumb, separating the blood-vessels from the vas deferens, must pass a ligature between them, and having tied the former only, must cut through the whole chord, at a quarter or half an inch distance from the said ligature, according as the state of the process and testicle will admit. This done; he is then, with the same knife, with which he has performed the former part of the operation, to dissect the testicle out from its connexion with the scrotum: the loose texture of the connecting cellular substance, the previous separation of the testicle from the spermatic chord, and the help of an assistant to hold up the lips of the wound, will enable him to do this with very little pain to the patient and great facility to himself. If any considerable artery bleeds in the scrotum, it is to be tied. (*Pott.*)

Mr. S. Sharp once castrated a man, whose testicle weighed above three pounds, and some of the vessels were so exceedingly varicous and dilated, as nearly to equal the size of the humeral artery. (*Operations of Surgery, chap. 10.*)

Desault first divides the chord, and, holding its upper end between the index finger and thumb of his left hand, he then takes up the arteries with a pair of forceps, and they are immediately tied by an assistant. (*Œuvres Chir. par Bichat, T. 2.*)

The spermatic artery, and any scrotal vessels, which require to be taken up, should be tied with fine silk ligatures, as re-

commended by my friend Mr. Lawrence. (See *Med. Chir. Trans. Vol. 6, p. 197.*)

Pott used to fill the cavity of the wound with lint; but Desault, and all the modern surgeons of this country, bring the edges of the wound together, and endeavour to heal as much of it as possible by the first intention. Some, with this view, use sutures and sticking plaster; others, only the latter, aided with compresses and a T bandage; which means, in my humble opinion, are quiet enough.

The operation of the compresses and bandages cannot be too carefully attended to, as it is the surest means of preventing hemorrhage from any small arteries in the scrotum, while it conduces to the union of the parts. Care must be taken, however, not to let the pressure hurt the sound testicle.

The plan of dressing adopted by Mr. Lawrence, consists in retaining the edges of the skin in apposition with two or three sutures, and then applying a narrow strip of simple dressing. A folded cloth, kept constantly damp, is also laid over the wound. (*Med. Chir. Trans. Vol. 6. loc. cit.*) With respect to sutures, some doubt may be entertained of their utility after this operation, and I have remarked, that considerable irritation and an extensive erysipelas sometimes follow their employment. Roux also noticed their bad effects in a case, which occurred during his visit to this country. (See *Parallèle de la Chirurgie Angloise avec la Chirurgie Française, p. 121.*)

It is somewhat extraordinary, that Larrey should condemn the plan of uniting the wound, though, indeed, we cannot be surprised at his delivering this advice, when we recollect that he disapproves of healing the stump, after amputation, by the first intention. The passage, relative to dressing the wound after castration, seems to be a contrast to the sensible observations which generally prevail in this author's publication: "*Il ne faut pas, réunir les bords de la plaie, comme l'ont conseillé quelques praticiens, parce qu'ils doivent suppurer, et que la suppuration est nécessaire.*" (*Mém. de Chirurgie Militaire, Tom. 3, p. 426.*)

Larrey is joined by Roux and the rest of the French surgeons on this point. The main reasons, stated by the latter writer, for not bringing the wound together, are, that secondary hemorrhage cannot be well guarded against, except by filling the part with charpie; that the redundancy and looseness of the skin render it difficult to keep its edges in exact contact, without removing a portion of it, and using sutures, which are objectionable; and that suppuration cannot commonly be prevented, because there is a large quantity of loose cellular substance in the wound, which substance readily suppurates. (*Parallèle de la Chirurgie Angloise avec la Chirurgie Française, &c. p. 119, &c.*) By applying cold water, and gentle compression to the part, I believe, however, such hemorrhage may generally be averted, and the union of the

wound materially expedited. As a judicious writer observes: "In the London hospitals, complete union by the first intention is seldom, or never accomplished; yet, by attempting it, the wound is much diminished, and the cure of it rarely delayed later, than three or four weeks; whereas the wound, when stuffed with lint, is usually not healed in less than seven or eight weeks." (See *Sketches of the Medical Schools of Paris by J. Cross, p. 144.*)

Sometimes, one or more vessels begin to bleed soon after the patient is in bed, although they effused no blood just after the removal of the testicle. Keeping the dressings and scrotum continually wet with the cold saturnine lotion very often suffices for the prevention and suppression of such hemorrhage: if not, the wound must be opened again, and the vessels tied.

J. L. Petit made some useful remarks on this operation. The vessels of the scrotum, says he, are not the only ones, which may be the source of hemorrhage. Anatomists know, that the septum, which divides this part into two cavities, is furnished with an artery, that is not considerable, but, which becomes materially enlarged, in the case of a sarcocele, or other tumour. It is sometimes so considerable, that it causes a bleeding, which makes a surgeon, who has had no previous opportunity of seeing the occurrence, exceedingly uneasy. Such hemorrhage, says Petit, may be easily suppressed with a ligature; and, he assures us, that he has seen a surgeon dress the patient three times, without ever suspecting, that the bleeding, for which the applications were a third time removed, proceeded from this artery. (*Petit, Traité des Maladies Chir. T. 2, p. 524—525.*)

The same experienced and able surgeon also acquaints us, that he has more than once extricated from trouble, persons who knew not how to stop the bleeding after the operation. He has seen some of them take off the dressings several times, without discovering the wounded vessel. As they imagined, that the only hemorrhage, which could follow castration, must be from the spermatic artery, they contented themselves with examining the ligature on the chord, and increasing the compression, in order to stop the bleeding; but, finding their attempts fail, they were compelled to seek assistance. On being sent for, M. Petit found, that the blood did not issue from the cord, but from a small artery under the skin, at the inferior angle of the wound. He easily stopped the hemorrhage, and explained, not only, that the cord had no share in the accident, but, that it is generally suspected without foundation. Indeed, says he, the least constriction will stop the bleeding from the spermatic artery; it is not essential to tie it;—"I myself am content with cutting the cord, so as to leave it rather longer than usual, and apply no ligature; I press it against the os pubis, near the ring of the external oblique; I lay over it a linen compress, half as thick as

the finger, two inches in length, sufficiently broad to cover the part, and yet narrow enough to be placed entirely within the wound. Over this compress, I put dossils of lint ; I fill the scrotum with plain lint, and then cover the whole with compresses, observing to put one, which is thicker than the rest, above the pubes, immediately over that which I have laid upon the cord, so that the bandage may make moderate pressure on this last part, yet sufficient to prevent bleeding." (*Op. cit.* p. 526, 527.)

This quotation is not made with a view of inducing any modern operator to imitate the preceding practice, which, indeed, the advantages of the present mode of dressing the wound entirely forbid, as well as the greater security of the ligature ; but, the passage is cited, for the express purpose of impressing on the mind of the young surgeon, that, in general, after the removal of a diseased testis, there is more risk of bleeding from the vessels of the scrotum, than those of the cord. I have never seen hemorrhage from the spermatic artery give trouble after the operation, but, have often known surgeons obliged to take off the dressings on account of bleeding in the scrotum.

In every operation, in which a considerable portion of skin is to be divided, and particularly in this, and in the amputation of women's breasts, it should always be remembered, that, as the division of the skin (the general organ of sensation) is the most acute and painful part of what is done by the knife, it cannot be done too, quickly, and should always be done at once: the scrotum should constantly be divided to the bottom, and the circular incision in the skin of a breast always made quite round, before any thing else be thought of. If this be not executed properly, and perfectly, the operation will be attended with a great deal of pain which might be avoided, and the operator will be justly blameable. (*Pott.*)

When the diseased testicle is exceedingly large, or a part of the scrotum is diseased, the surgeon should take care to remove the redundant, or morbid portion of the skin, by including the piece, which he designs to take away, within two long elliptical incisions, which are to meet at the upper and lower part of the swelling. In this manner, as Mr. Samuel Sharp has observed, the hemorrhage will be much less, the operation greatly shortened, the sloughing of the distended skin prevented, and the recurrence of cancerous disease rendered less likely. (*See Treatise of the Operations, chap. 10.*)

Mr. Lawrence concurs with M. de la Faye in thinking it best in this operation always to remove a large piece of the scrotum with the testicle, by which means the surface of the wound is lessened. (*See Med. Chir. Trans. Vol. 6, p. 196.*)

If the tumour be of a pyriform figure, perfectly smooth, and equal in its surface, and free from pain, notwithstanding the degree of hardness may be great, and the surgeon may in his own opinion, be clear that the tumour is not produced by water, but is a

true scirrhus, let him, immediately previous to the operation, pierce the anterior part with a trocar, in order to be certain. "My reason for giving this advice is, that I was once so deceived by every apparent circumstance of a true, equal indolent scirrhus, that I removed a testicle, which proved upon examination to be so little diseased, that, had I pierced it with a trocar previous to the operation, I could, and certainly should have preserved it." (*Pott.*)

It is well known, that the agony of tying the cord is immensely increased by including the vas deferens, and, as no good results from so doing, the practice deserves the severest reprobation, notwithstanding the opposite opinion of Mr. Pearson, (*Pract. Obs. on Cancer, p. 74.*) and the writer of the article *Castration* in Rees's Cyclopædia.

Cases are even recorded, in which the inclusion of the whole of the spermatic cord appears to have occasioned severe and perilous consequences, and these in so great a degree, that it has been found necessary to cut and remove the ligature. Sometimes, says Petit, patients on whom castration has been performed, suffer more or less acute pain in the kidneys. The suffering often becomes insupportable and highly dangerous, the belly being swelled, tense, and painful ; the patient being affected with syncope, and affections of the heart, sometimes with vomiting, and retention of urine ; lastly, an universal inflammation of the belly, and a violent fever, accompanied with delirium, are occasionally the fatal consequences of this operation. Petit was required to visit a patient, who had been in this deplorable state for twenty-four hours, after having suffered castration, and this distinguished surgeon could impute the sudden and violent symptoms to nothing, except the ligature on the spermatic cord ; consequently, he advised the ligature to be removed. The patient received some slight relief from this step, and, after having been bled twice within a short space of time, he found himself a great deal better ; but, as the dressings became wet with blood, apprehension of bleeding began to be entertained. Petit, therefore, had recourse to moderate compression of the cord, in the manner above related. No hemorrhage ensued ; the case afterwards went on well ; and the patient recovered sooner than was expected. (*Traité des Maladies Chir. Tom. 2, p. 527, 528.*)

In the operation of removing a testicle, one caution seems particularly necessary, viz. if the cord should be at all enlarged, the surgeon ought carefully to examine, whether the augmentation of its size may not be owing to a portion of intestine, or omentum, that is contained within it. (*See Sabatier's Médecine Opératoire, Tom. 1, p. 332, Edit. 1.*) In one case of extirpation of the testicle, "after the operation was completed, and the wound dressed, the patient being seized with a fit of coughing, to the astonishment and dismay of the surgeon, the dressings were forced off by a protrusion of several convolutions of small intes-

tines; from this, it was proved, that the patient had had a hernia; but, the diseased enlargement of the testicle had acted as a truss, and prevented the rupture from coming down. (See *Operative Surgery*, by C. Bell, Vol. 1, p. 226, also p. 224.)

There is another circumstance, which merits attention in the performance of this operation: when there are reasons, which oblige us to divide the cord high up, and this part has not been tied before such division is made, it may be drawn up by the cremaster within the abdominal ring, and some difficulty may be experienced in securing the spermatic arteries. Mr. B. Bell saw this happen twice, and the patients lost their lives from hemorrhage. Hence, when it is necessary to cut through the cord near the ring, perhaps it may be best always to apply the ligature first observing not to include the vas deferens. However, were the cord, previously to the application of ligatures to its arteries, to happen in any instance to be drawn up within the ring, a surgeon would be guilty of most supine neglect to let the patient die of bleeding; for, as Mr. C. Bell has remarked, we may follow the cord with perfect safety, even to the origin of the cremaster, which pulls it up, if attention be paid to the course of the cord, obliquely upward and outward, within the inguinal canal.

It sometimes happens, that abscesses form in the remains of the spermatic cord, after the operation of castration. Such suppuration may frequently be prevented by the employment of bleeding directly after the operation, and repeating the evacuation on the first access of the inflammation of the part concerned. Besides venesection, low diet, neutral salts, diluents, &c. are indicated, and the part should be covered with an emollient poultice. When pus is completely formed, the abscess should be opened.

When the symptoms subside, says Petit, they, who are little versed in practice, are apt to fancy the abscess cured; but, they are sometimes mistaken. The matter is not always sufficiently near the surface to be felt, and, in this circumstance, the aponeurosis of the external oblique muscle is so tense, that it hinders the fluctuation from being distinctly felt. Indeed as the matter finds a lodgment under this aponeurosis, following the course of the sheath of the vessels, there is reason to fear, that it may lead to additional inflammation and suppuration, and extend up the duplicature of the peritoneum to the loins. In these cases, the abscess occasionally makes its way outward, and the dressings are inundated with matter; but, if this should not happen quickly, the sooner the tumour is opened the better. The opening ought unquestionably to be made wherever the fluctuation is plainly distinguishable; but, as Petit has remarked, the tension of the aponeurosis of the external oblique muscle makes the undulation of the matter less readily and plainly perceptible, than if the abscess were only in the fat. Therefore, in order to avoid mistake, this

surgeon advises us to feel at the abdominal ring, as, in general, the pus can be more readily felt here, than in other situations. If matter is felt, and no resistance is experienced, Petit advises the finger to be passed into this opening, and in case the seat of the abscess should be found to be under the aponeurosis, we are recommended to divide, with a probe-pointed bistoury, the skin and fat immediately covering the ring, then to separate the fibres of this aperture, as it were, without cutting them (See *Traité des Maladies Chirurgicales*, Tom. 2, p. 529—530.) No doubt, this surgeon meant, that the division of the tendon ought to be made in the direction of its fibres.

Consult *Le Dran's Operations*. Sharp's *Operations of Surgery*, chap. 10. *Pott on the Hydrocele*, &c. *Sabatier, de la Méd. Oper.* Tom. 1. *Bertrandi Traité des Opér. de Chirurgie*, Chap. 11. *Oeuvres Chirurgicales de Désault par Bichat*, Tom. 2, p. 449. *Larrey Mémoires de Chirurgie Militaire*, Tom. 3, p. 423, &c. *Pearson on Cancerous Complaints*. *J. L. Petit, Traité des Maladies Chirurgicales*, Tom. 2, p. 519, &c. *C. Bell's Operative Surgery*, Vol. 1. *Richerand's Nosographie Chirurgicale*, Tom. 4, p. 281, &c. *Edit 2*, &c. *A long account of the particular sentiments of several eminent surgeons is to be found in Rees's Cyclopædia*, art. *Castration*. *Roux, Parallèle de la Chirurgie Angloise avec la Chirurgie Française*, p. 119. &c. *Lawrence in Med. Chir. Trans.* Vol. 6, p. 196—197. *Sketches of the Medical Schools of Paris*, by J. Cross, p. 139, &c.

CATAPLASMA ACETI. Made by mixing a sufficient quantity of vinegar with either oatmeal, linseed meal, or bread crum. When linseed is employed, it is best to add a little oatmeal, or bread crum, in order to keep the poultice from becoming hard. The vinegar poultice is generally applied cold, and is principally used in cases of bruises and sprains.

CATAPLASMA ACETOSÆ. *Sorrel Poultice.* \mathcal{R} *Acetosæ* ℞j. To be beaten in a mortar into a pulp.

CATAPLASMA ALUMINIS. Made by stirring the whites of two eggs with a bit of alum, till they are coagulated. In cases of chronic and purulent ophthalmia, it has been applied to the eye, between two bits of rag, and it has been praised as a good application to chilblains, which are not broken.

CATAPLASMA BYNES. (Malt.) \mathcal{R} *Farinæ Bynes*, *Spumæ Cerevisiæ*, q. s. This is applied to cases of gangrene and ill conditioned extending sores. It is used in instances similar to those, in which the cataplasma fermenti is employed, and, by giving out carbonic acid gas, is supposed to operate as a gentle stimulus, and as a corrector of fetid effluvia.

CATAPLASMA CARBONIS. Made by mixing powdered charcoal with linseed meal and warm water, and is applied to improve the condition of several kinds of unhealthy sores.

CATAPLASMA GEREVISIÆ. Made

by stirring some oatmeal or linseed meal, in strong beer grounds. It is used in the same cases, as the Cataplasma Fermenti, and Cataplasma Bynes.

CATAPLASMA CICUTÆ. *Hemlock Poultice.* R. *Herbæ cicutæ exfoliatæ* ℥ij. *Aquæ fontanæ* ℔ij. To be boiled, till only a pint remains, when as much linseed meal as necessary is to be added.

This is an excellent application to many cancerous and scrofulous ulcers, and other malignant sores; frequently producing a great diminution of the pain of such diseases, and improving their appearance. Justamond preferred the fresh herb, bruised.

CATAPLASMA DAUCI. *Carrot Poultice.* R. *Radicis Dauci recentis* ℔j. Bruise it in a mortar into a pulp. Some, perhaps, with reason, recommend the carrots to be first boiled. The carrot poultice is employed as an application to ulcerated cancers, scrofulous sores of an irritable kind, and various inveterate malignant ulcers.

CATAPLASMA DIGITALIS. Made by mixing linseed meal with a decoction of the leaves of the plant. It is said to have great sedative virtues, to be adapted to the same cases as the cicuta poultice, and even to be more beneficial.

CATAPLASMA FARINACEUM. The bread and milk poultice, made by putting some slices of bread crum in milk, and letting them gently simmer over the fire in a saucepan, till they are properly softened. The mass is then to be mixed and stirred about with a spoon, and spread on linen, in order to be applied. This poultice, which is of the emollient kind, is with many persons the common one for all ordinary purposes. Most surgeons, however, employ, instead of it, the linseed poultice, which is cheaper, more readily made, not apt to turn sour, and in all common cases, quite as advantageous in every respect.

CATAPLASMA FERMENTI. *Fermenting Poultice.* R. *Farinæ Triticæ* ℔j. *Cerevisiæ Spumæ, Vest dictæ* ℔ss. These are to be mixed together and exposed to a moderate heat, till the effervescence begins. In cases of sloughing and many ill-conditioned ulcers, this is an application of great repute.

CATAPLASMA LINI. *Linseed Poultice.* R. *Farinæ Lini* ℔ss. *Aq. ferventis* ℔ss. The powder is to be gradually sprinkled into the hot water, while they are quickly blended together with a spoon.

This is the best and most convenient of all the emollient poultices for common cases, and it has nearly superseded that of bread and milk, which was formerly much more frequently employed.

Mr. Hunter speaks in the following terms of the linseed poultice and its uses.

"Poultices are commonly made too thin; by which means, the least pressure, or their own gravity, removes them from the part; they should be thick enough to support a certain form when applied.

"They are generally made of stale bread and milk. This composition, in general,

makes too brittle an application; it breaks easily into different portions, from the least motion, and often leaves some part of the wound uncovered, which is frustrating the first intention.

"The poultice which makes the best application, and continues most nearly the same between each dressing, is that formed of the meal of linseed; it is made at once, and when applied, it keeps always in one mass.

"The kind of wound to which the above application is best adapted, is a wound made in a sound part, which we intend shall heal by granulation. The same application is equally proper when parts are deprived of life, and consequently will slough. It is therefore the very best dressing for a gunshot wound, and probably for most lacerated wounds; for lint, applied to a part that is to throw off a slough, will often be retained till that slough is separated, which will be for eight, ten, or more days."

CATAPLASMA MALI MATURI. This is made by roasting a ripe apple, removing the peel and core, and beating the pulp into a soft mass. It is sometimes applied to inflamed eyes, by means of a little muslin bag.

CATAPLASMA MURIATIS SODÆ. R. *Pulveris Lini, Micæ Panis ā. ā. partes æquales, Aq. Sodæ Muriatæ q. s.* This is used for diminishing scrofulous tumours and glands. When it excites too much irritation in the skin, a linseed poultice may be substituted for it, until this state has subsided.

CATAPLASMA PLUMBI SUBACETATIS.

R. *Liquoris Plumbi Subacetatis* drach. j. *Aquæ distillatæ* lib. j. *Micæ panis q. s.*—Misc.

Practitioners who place much confidence in the virtues of lead, externally applied, often use this poultice in cases of inflammation.

CATAPLASMA QUERCUS MARINI.

This is prepared by bruising a quantity of the marine plant commonly called *sea tang*, which is afterwards to be applied by way of a poultice.

Its chief use is in cases of scrofula, white swellings, and glandular tumours.

When this vegetable could not be obtained in its recent state, a common poultice of sea-water and oatmeal was substituted by the late Mr. Hunter and other surgeons of eminence.

CATARACT. (From *καταρσσω*, to confound or disturb; because the disease confounds or destroys vision.) *γλαυκωμα, ὀφθαλμία. Gutta opaca. Suffusio. Der grane Staar.*

A cataract is usually defined to be a weakness or impediment to sight, produced by opacity of the crystalline lens, or its capsule. Professor Beer applies the term to every perceptible obstacle to vision, situated in the posterior chamber, between the vitreous humour and the uvea. (*Lehre von*

Augenkrankheiten, B. 2, p. 279, 8vo. Wien. 1817.)

Hippocrates and the ancient Greeks described the cataract, as a disease of the crystalline lens under the name of *καταρχα*; but, no sooner had Galen promulgated the doctrine of the lens being the immediate organ of sight, than the correct opinion of the ancient founder of medicine began to decline, and for many ages afterwards, had no influence in practice. In fact, the seat of the cataract was entirely forgotten, till about 1656, when first Lasnier, and, afterwards, Borel, Bonnetus, Blegny, Geoffroi, &c. revived the truth which had been so long extinct; and they, and a few others, believed, that the disease was situated in the crystalline lens. The bulk of practitioners, however, remained ignorant of this fact even as late as 1713, or, in other words, until the several publications of Mery, Maitre-Jan, Brisseau, and Heister, combined to render the truth universally known.

A cataract, even in its highest degree, does not always produce complete blindness. For the most part, its formation takes place slowly; the cases in which it originates very quickly, being but few, and those in which it is suddenly produced in a complete form, still more unusual.

The characteristic symptoms, commonly remarked when a cataract is slowly formed, are the following: 1. All objects, especially white ones, seem to the patient to be covered by a thin smutty or dusty cloud, which as the late Mr. Ware observed, is generally perceptible by the patient before any opacity is visible in the pupil. 2. The decline of vision bears an exact proportion to the increasing opacity distinguishable behind the pupil. 3. In most cases, the opacity is first discerned behind the pupil, most plainly also at the central point. The instances in which it first presents itself at the edge of the pupil, being less frequent.— 4. In eyes with a light-coloured iris, the more progress a cataract makes the more clearly can one perceive at the edge of the pupil a blackish ring, which partly arises from the shadow of the iris falling on the cataract, but chiefly from the dark coloured pupillary edge of the iris, which, in a clear pupil cannot be seen, but now that a grayish surface lies behind it, is very manifest. As a cataract generally begins at the central point behind the pupil, such objects as are placed directly in front of the eye, are most difficultly seen even in the early stage of the disease, but those which are laterally placed, especially when the light is not too strong, and of course the pupil a good deal dilated, can yet be seen tolerably well. 6. Hence, when the opacity, at the central point behind the pupil, is at all considerable, the patient is completely blind in a strong light, while on the contrary, in a moderately dark room, a degree of vision is yet enjoyed. When the opacity is not far advanced, the eyesight may be improved for a short time by the patient's turning

his back to the light. 7. Persons with incipient cataracts derive the greatest palliative aid from the use of convex glasses, because objects are magnified by them; but, they only answer while the opacity is inconsiderable. 8. To such patients, the flame of a candle seems to be enveloped in a whitish misty halo, which always becomes broader, the further the patient is from the light. When the cataract is far advanced, the flame of the candle cannot be seen, and the patient can only indicate the place near which the light is, or say whether it is close or at a distance. 9. Lastly, a cataract which forms slowly, produces in the course of its progress, no change in the mobility of the iris; and, if this effect sometimes takes place where the disease is very completely developed, the nature of the case is now so manifest, that no surgeon is in any danger of mistaking the complaint for amaurosis.

The characteristic appearances of amaurosis are entirely different. 1. The opacity, perceptible behind the pupil, is at a considerable distance from this opening, as may be best seen when the eye is viewed sideways. 2. The opacity is somewhat concave. 3. Its colour inclines rather to a greenish, or reddish cast, than to gray. 4. The decline of the eyesight is not at all in a ratio to the degree of opacity, the patient being almost blind. 5. The pupil is more or less dilated; the iris nearly or quite motionless, its pupillary edge being here and there thrown into an angle, and of course it is not exactly circular. 6. Even the cornea itself is not quite so clear and transparent as in the natural state. 7. The temporary increase or diminution of blindness, so common in patients with incomplete amaurosis, never depends, as in those with cataracts, upon the degree of dilatation of the pupil, or the degree of light, but upon causes, which tend either to depress, or excite the system. 8. The misty halo, which such amaurotic patients perceive around the flame of a candle, is not like a whitish cloud, but has all the hues of the rainbow: indeed, the flame itself presents these colours, and when the patient goes to some distance from it, it generally seems split.— 9. At no period of the complaint are spectacles of any service in enabling the patient to see better. 10. Lastly, such objects as are situated to one side, cannot be seen more plainly than those which are directly in front of the eye. (See *Beer's Lehre von den Augenkr.* B. 2, p. 281—284.)

According to this author, the first and most important division of cataract is into the *genuine* and *spurious*; for the obstacle to vision, situated in the posterior chamber, between the vitreous humour and the uvea, and making what is termed a cataract, may be either within the limit of the capsule of the lens, or between the anterior layer of that capsule and the uvea. The first case is the *genuine*; the *second*, the *spurious* cataract.

A genuine cataract, when a primary dis-

ease, and unattended from the first with other morbid effects in the eye, is mostly a single independent affection; on the contrary, as the spurious cataract is generally the consequence of internal ophthalmy, it is almost always more or less combined with a partial opacity of the anterior layer of the capsule, and, of course, with a genuine cataract.

The first variety of genuine cataract, noticed by Beer, is that which he calls *lenticular*; it always begins in the centre, or very nucleus of the lens, mostly presenting a very dull yellowish-gray colour, which is somewhat deeper at the centre, than at the margin of the pupil; a character retained even when the disease is in its most complete stage. The lenticular cataract is always formed very slowly, and except when the iris is too dark coloured, it is more or less attended with a blackish ring at the edge of the pupil, which ring becomes plainer as the disease advances. A genuine lenticular cataract never causes any alteration in the expansion or contraction of the iris; nor does it even in its highest degree deprive the patient of all power of vision, the patient in shady places, or when the pupil is artificially dilated with hyosciamus, being often capable of distinguishing pretty well many objects, which are placed laterally with respect to the eye. A lenticular cataract also is usually at some distance from the uvea, so that the extent of the posterior chamber is manifest, while the opacity presents more or less of a convex appearance, and never that of very white cloudy specks. Frequently, as Beer observes, the lenticular cataract is unattended with any change in the capsule, or the liquor of Morgagni. In most cases of senile cataract, not preceded by inflammation, the capsule is said to remain transparent. (*Travers, Synopsis of the Diseases of the Eye*, p. 207, 8vo. Lond 1820.)

The second species of genuine cataract, noticed by Beer, is the *capsular*, which he thinks should not be called *membranous*, as the expression may lead to mistake. The disease seldom commences in the centre of the pupil, and usually arises at its margin in the form of distinct, very white, shining points, streaks, or specks; its colour, therefore, is always very light, and never altogether uniform, even when the disease is completely formed. The dotted, or mottled appearance of this cataract, is also particularly noticed by Mr. Travers. (*Synopsis of the Diseases of the Eye*, p. 207.) The blackish ring, which when the iris is light coloured, is even more evident in this, than the lenticular cataract, is here not owing to the shadow of the iris, but to its dark border; for this cataract is too near the iris for any shadow to be formed. This observation, however, is somewhat at variance with what Mr. Travers has remarked; for when a transparent circumference can be seen on dilating the pupil with belladonna, Mr. Travers has never found the

capsule opaque; and he believes, that the black rim may be considered as the diagnostic mark of the transparency of the capsule. But, where the opacity of the lens is diffused, this sign is of course absent. (*Med. Chir. Trans. Vol. 4*, p. 288.) The disease also has some effect on the motions of the iris, at least, their quickness. A capsular cataract never remains long the only affection, but is followed by disease of the lens itself; a fact, says Beer, which cannot surprise us, when we consider, that it is through the medium of the capsule, that the particles of the lens are incessantly undergoing the changes of removal and reproduction.

The capsular cataract is subdivided by Beer into the *anterior capsular cataract*; the *posterior capsular cataract*; and the *complete capsular cataract*, in which both the front and back portions of this membrane are opaque.

The *anterior capsular cataract*, which is not at all unfrequent, does not continue long in this form after it has attained a high degree, but, according to Beer, becomes combined with an opacity, and, according to Mr. Travers, with a slow absorption of the lens itself. (*Synopsis*, &c. p. 207.) "When the capsule is completely opaque, (says Mr. Travers) we can hardly judge of the texture of the lens." But, in such examples, "the lens is commonly diminished in bulk; it undergoes a waste after the opacity of the capsule, so as in process of time to become a membranous cataract. This I conceive to be owing to the obliteration of the vessels of the capsule, from which those of the lens are derived. When the capsule is completely opaque, it is either purely capsular, or only a very small piece of lens remains. When the capsule turns opaque from injury, the lens is soon greatly reduced in bulk, as appears from the falling in, or concavity of the iris, which loses its support, and is demonstrated in the operation. This observation renders the operation with the needle appropriate to the cataract, in which the capsule is opaque, in cases which are not very recent." (*Med. Chir. Trans. Vol. 4*, p. 286.) The anterior capsular cataract, may be known by its light gray, and in some places, completely chalk-white colour, intersected by shining, mother-of-pearl-like streaks and spots. As the capsule is at the same time thicker than natural, the posterior chamber is lessened, and the cataract is not unfrequently close to the uvea, especially when the lens has also completely lost its transparency. In this stage, the movements of the iris are likewise rendered less quick, and the shadow at the margin of the pupil is entirely absent. Hence, vision is not only hurt, but quite impeded, in regard to any correct sensation of light, whether the patient be in a light, or shady situation; and frequently a faint light is completely invisible to him.

The *posterior capsular cataract* belongs to the rarer forms of the disease of the eye, but

says Beer, when it happens, *the lens always participates in the opacity, much more quickly, than occurs in the anterior capsular cataract*. Hence, the disease can never be observed up to its perfect development. Respecting the state of the lens, some difference prevails between the statement of Beer and that of Mr. Travers: the latter gentleman informs us, that where the opacity of the posterior capsule is met with, which he agrees with Beer in considering as very rare, *the lens and anterior capsule are usually transparent*; "and when this is not the case, and the cataract escapes with a posterior fold of opaque capsule, it is always accompanied with a considerable discharge of vitreous humour. (*Synopsis of the Diseases of the Eye*, p. 209.) And, in speaking of the opacity of the posterior capsule, in another work, he informs us, that he has not observed, that, in this case, the lens undergoes any diminution. (*Med. Chir. Trans.* Vol. 4. p. 286.) Like the anterior capsular cataract, it is denoted by a whitish-gray, unequal variegated colour; but no light-coloured, chalk-white spots and streaks are ever discernible, which while the lens retains its transparency may be owing to the distance of the cataract from the pupil. However, the opacity situated behind the pupil, always seems concave, when the eye is inspected, not from before, but from every side of it. While the posterior half of the capsule is not completely opaque, the lens is not materially affected; the eyesight is only more or less weakened; and sometimes, especially with the aid of a magnifying glass, a tolerable degree of vision is enjoyed, notwithstanding the considerable opacity behind the pupil. This species of cataract has not itself any influence over the motions of the iris, and after the lens becomes opaque, it is not softened.

Though the *complete capsular cataract* is not the rarest species of genuine cataract, it cannot be said to be very common. In addition to the symptoms of the anterior capsular cataract, it presents few, yet decided characters, which indicate it previously to an operation: viz. the iris is nearly motionless, the cataract lying close to that organ; the posterior chamber for the same reason is effaced; and an inexperienced surgeon might really suppose the anterior portion of the capsule were adherent to the uvea, unless he convinced himself of the contrary, by producing an artificial dilatation of the pupil with hyosciamus, or belladonna. Sometimes, the iris even seems thrust out, by this large cataract, towards the cornea in a convex form; and the patient can only perceive the strongest kinds of light.

The third species of genuine cataract is the *cataracta Morgagniana*, which some term the milk cataract, and others confound with the purulent cataract. It is one of the rarest forms of the disease; so rare indeed, that Mr. Travers regards the case as purely hypothetical. (*Synopsis of Diseases of the Eye*, p. 208.) The following is the form of disease, described by Beer, under

this name; it proceeds from a total conversion of the lens into a milky fluid, or thin jelly, frequently attended with a complete capsular cataract. Its origin is said to be always quick, and an immediate effect of chymical injuries of the eye, especially those produced by the gases formed when a metal is oxydated by a mineral acid. The following are the symptoms of the case, while it is uncomplicated with disease of the lens and capsule; a state, which can never continue long. Though the colour is milk-white, it is delicate and thin, like that of diluted milk.

The whole pupil seems cloudy, but whenever the eye-ball moves suddenly and violently, or the eyelid is rubbed over the eye, the opaque substances change their shape and position. The posterior chamber is nearly annihilated, which may be owing to the quantity of fluid, or gelatinous substance collected. While the lens and capsule are not materially changed, the sight suffers only a diminution, though it is very cloudy, and small objects cannot be distinguished at all. When, however the lens and capsule become opaque, vision is quite abolished, a certain power of knowing light from darkness only remaining. Not unfrequently, says Beer, when the lens itself is in a dissolved state, the capsule is partially opaque, the eye is kept quiet for a few minutes, and the patient stands or sits in an upright posture, two rows of opaque matter can be plainly seen; the upper being the least white of the two; the lower presenting a chalky whiteness. However, as soon as the patient suddenly or violently moves his eye, or head, or the eyelid is rubbed over the eye, both these rows of opaque matter disappear, and the colour of the opacity behind the pupil again seems uniform.

The fourth species of genuine cataract, described by Beer, is the *capsulo-lenticular cataract*, to which he conceives the liquor of Morgagni in an altered state, may likewise often contribute, as may be inferred from the prodigious size of this cataract. It is by no means uncommon, and is attended with the following characteristic symptoms. The colour of the opacity close to the uvea, is partly chalk-white, partly like that of mother-of-pearl, and, in many places, both these colours can be evidently seen disposed one over the other, that of mother-of-pearl, however, being always most superficial. Exposure of the eye to the most vivid light scarcely causes any motion of the iris, but the pupil is circular, without any angles in it. After the application of the extract of henbane, the iris contracts again exceedingly slowly, and the pupil is long in returning to its former diameter. Besides the obliteration of the posterior chamber the anterior one itself is mostly diminished, in consequence of the iris being pushed towards the cornea by the very large size of the cataract, and hence, the sensation of light is very indistinct.

The capsulo-lenticular cataract is not unfrequently the consequence of a slow inflam-

matory process in the iris, the lens and its capsule; and hence, several varieties of this case, and its not unfrequent combination with a spurious cataract; all which different modifications, says Beer, should be correctly understood previously to an operation, in order to form a just prognosis of its event, and to know what method of operating ought to be adopted.

Of these varieties the first is the *capsulo-lenticular cataract*, conjoined with slight depositions of new matter upon the anterior capsule of the lens. These after-formations upon the front layer of the capsule, as Beer calls them, put on very different appearances, and accordingly receive various appellations. For instance, the *marbled capsulo-lenticular cataract*, when the chalk-white new formed substances upon the anterior layer of the capsule are so arranged as to resemble the variegated appearance of marble. The *window*, or *lattice capsulo-lenticular cataract*, when the new-deposited substances cross each other, leaving darker coloured interspaces. The *stellated capsulo-lenticular cataract*, when the new matter runs in concentric streaks, towards the middle of the pupil. The *central-capsulo-lenticular cataract*, when a single, elevated, white, shining point is formed on the anterior capsule, while the rest of this membrane is tolerably clear, and the lens not completely opaque. The *dotted capsulo-lenticular cataract*, when the front layer of the capsule presents several distinct unconnected dispositions on its surface. The *half-cataract*, or *cataract capsulo-lenticularis dimidiata*, when one half of the front layer of the capsule is covered with a white deposit. In all these, and some other examples, says Beer, the lens is found to be converted to its very nucleus into a gelatinous, or milk substance.

The second variety of the capsulo-lenticular cataract, pointed out by Beer, is the *encysted*, indicated by its snow-white colour; sometimes lying so close to the uvea, as to push the iris forward towards the cornea; and, at other times, appearing to be at a distance from the uvea. These circumstances, as Beer remarks, almost always depend upon the position of the head; for, when this is inclined forwards, the cataract readily assumes a globular form, and projects considerably towards the anterior chamber. Frequently, this variety of the capsulo-lenticular cataract constitutes the kind of case, to which the epithets, *tremulous* or *shaking* and *swimming*, or *floating*, are applied. According to Beer, the reason of such unsteadiness in the cataract is owing to the broken, or very slight connexion of the capsule of the lens with the neighbouring textures. The same author has never seen any case of this kind, which had not been preceded by a violent concussion of the eye, or adjacent part of the head. Both layers of the capsule are opaque, and sometimes considerably thickened. The third variety of the capsulo-lenticular cataract, described by Beer, is the *pyramidal*, or *con-*

cal, which is one of the rarer forms of the disease, and always brought on by violent internal inflammation of the eye, especially affecting the lens, its capsule, and the iris. It may be known by a white, almost shining, conical, more or less, projecting new-formed substance, which grows from the centre of the anterior layer of the capsule, and is almost in close contact with the pupillary margin of the iris. Hence, the iris is always quite motionless, and the pupil angular. Sometimes, this growth from the capsule extends itself so far into the anterior chamber, as nearly to touch the inner surface of the cornea, and sometimes actually to adhere firmly to it: a circumstance, says Beer, which is very constant in the conical staphyloma of the cornea, though not discoverable till the operation is performed. The power of discerning light is feeble and indistinct, and sometimes entirely abolished.

The fourth variety of the capsulo-lenticular cataract is that which is covered with a dry shell, or husk. Though principally met with in young children, it is not one of the most uncommon affections in adults, and in the former, it is often falsely regarded as a congenital complaint. When this cataract is extracted either from children, or grown-up persons, Beer says, that the dried shrivelled capsule is always found round the equally dry nucleus of the lens, like a husk, or shell. In children, however, he says, that the nucleus of the lens is often scarcely perceptible, while, in adults, it is always of considerable size, and this may be the reason, why this cataract in children does not present so bright a yellow-white colour, as it does in grown-up persons. In infants, in which it is frequently seen in the first weeks of their existence, it is manifestly produced by a slow and neglected inflammation of the lens and its capsule, arising from too strong light. In adults, the inflammation, exciting this form of cataract, is always owing to external violence; yet Beer supposes, that a considerable diminution of cohesion between the capsule and the adjacent textures must likewise have a principal share in bringing on the disease, which, in grown-up persons, is constantly preceded by a concussion of the eye-ball, from the cut of a whip, the lash of a horse's tail, &c. Professor Schmidt had never seen this kind of cataract except in boys and girls, who in their early childhood had been afflicted with convulsions; and hence, he thought, that the cause of the disease was owing to a partial loosening of the capsule from its natural connexions by the violence of the convulsive paroxysms. *Abhandlung über Nachstaar und Iritis nach Staar. operationen*, Wien. 1801, 4to.) However, Beer assures us, that he has seen infants, scarcely two months old, affected with this cataract, which had not been preceded, or followed by any convulsions; while a much larger number of children with the same kind of cataract had fallen under his notice, where more or less severe

blows on the head had been received. With respect to the convulsions, spoken of by Schmidt, he also questions, whether they and the cataract might not be owing to the same cause; viz. the preceding inflammation within the eye? In children, says Beer, this form of cataract may be known by its light gray, whitish, though seldom very white, colour, its diminutive size, and considerable distance from the uvea, and by the freedom, with which the iris moves; when no adhesions exist at any points between this organ and the cataract, as occasionally happens; a proof of the previous inflammation of the capsule, lens, and neighbouring textures. The eye-sight is never quite impeded, but only much diminished. On the contrary, in adults, as Beer has remarked, this cataract invariably presents a dazzling white hue, and only a few points of it are of a smutty yellowish white colour, whence the case has been sometimes termed the *gypsum cataract*. It is not convex, but rather flat; it does not approach the iris; and, when free from adhesions to the uvea, which are more likely to happen in adults, it has no effect on the motion of the iris. Vision is generally entirely lost, with the exception of the power of discerning the light, and, even this faculty is sometimes destroyed, in consequence of the previous violence done to the eye, whereby not merely the lens and its capsule, but also the retina, have suffered.

According to Beer, one of the rarest varieties of the *capsulo-lenticular cataract* is that accompanied with a *cyst of purulent matter*. It is indicated by a deep lemon colour, very slow motion of the iris, manifest abolition of the posterior chamber, slight convexity of the iris, trivial perception of light, and the weak, unhealthy constitution of the patient. The purulent cyst, which sometimes contains a very fetid matter, and was therefore called by Schiferli the *putrid cataract*, (*Theoretisch-Praktische Abhandlung über den Grauen Starr. 8vo. Jenn. and Leipz. 1797.*) may sometimes be taken out, without being broken, together with the whole capsule of the lens, with the aid of the forceps, or cataract-tenaculum, as was first correctly remarked by Professor Schmidt. In one single example, Beer found the cyst of matter between the lens and the anterior portion of its capsule. Mr. Travers has likewise seen an example of suppuration within the capsule, which projected through the pupil in a globular form, and was filled with pus. The case happened in a lad, and had been preceded by a severe blow on the eye. (*Synopsis of the Diseases of the Eye. p. 206.*)

The sixth, and last variety of the *capsulo-lenticular cataract*, mentioned by Beer, is the well-known case, described by the French under the name of *cataracte barrée*, the *bar-cataract*, and by Schmidt under the appellation of the *cataract, with a girth or zone*. The case, says Beer, is one of the least frequent. The diagnosis is easy; for, behind the diminished, more or less angular pupil, the cataract can be plainly seen, to

which is attached, either in a more or less perpendicular, or horizontal direction, a chalk-white, generally very shining, and thickish kind of bar, or girth, which is closely adherent at both its extremities to the pupillary margin of the uvea, and sometimes reaches, but often only on one side, more or less towards the ciliary processes. The iris is therefore completely motionless, the uvea not being merely adherent to the substance forming what is termed the *bar*, or *girth*, but also closely connected with the whole front portion of the capsule. The perception of light is either very indistinct, or quite lost, and, not unfrequently, the globe of the eye is somewhat smaller than natural. Beer says, that he has never met with this variety of cataract, except after violent internal inflammation of the eye. He describes the substance, composing the *bar* or *girth*, as being of various consistence, and sometimes firm and almost cartilaginous. In two cataracts of this sort, which he extracted from a boy twelve years of age, he found the *bar*, strictly speaking, ossified, and the capsule, which was nearly cartilaginous, was adherent to a very small, firm nucleus of the lens, though they were yet capable of separation. In a dead subject, Beer also examined such a cataract, in which the outer end of the *bar* scarcely extended to the greater ring of the uvea, but the inner end reached over the ciliary processes to the ciliary ligament, from which latter part it was inseparable. (*Lehre von den Augenkr. B. 2, p. 302.*)

OF SPURIOUS CATARACTS.

The most frequent, according to Beer, is what he names the *lymph-cataract*. It is, without exception, the effect of an inflammation, which is chiefly situated in the iris, the lens, and its capsule. Hence, it is frequently combined with a genuine cataract. The nature of the disease may be known from the patient's account, that the present blindness has been preceded by a painful tedious affection of his eye and head; and from an examination of the eye itself, in which the pupil will be found more or less diminished and angular; the iris either perfectly motionless, or nearly so; the eyesight, and even sometimes the perception of light, more or less impeded, or lost, and this not merely in proportion to the quantity of lymph observable immediately behind the pupil, but also in proportion to other morbid effects produced in the organ by inflammation. Lastly, the surgeon may notice directly behind the pupil a plastic lymph, either in the form of a delicate kind of network, or of a thick web of a snow-white colour. Sometimes, in this variety of spurious cataract, though very little coagulating lymph appears upon the anterior portion of the capsule of the lens, and what is effused, as well as the lens itself, is almost clear and transparent, yet, the eyesight is considerably impaired; and, on more careful examination of the pupil, something of a dark-brown colour is perceived, which often pro-

jects, at several points behind the pupillary edge of the iris, a good way towards the centre of the pupil. In this substance, one may discern, with a good magnifying glass, new vessels extending from those of the uvea, and formed by the previous inflammation, by means of which vessels, this mass, and the delicate layer of lymph, are connected with the capsule of the lens. According to Beer's sentiments, it is only the real lymph-cataract, which rightly deserves the epithet *membranous*, which is sometimes wrongly applied to the *capsular cataract*; for, says he, *the lymph-cataract alone consists of an adventitious membrane, formed by inflammation of a web of plastic lymph, which may be very thin, and semi-transparent, while the lens and its capsule are nearly quite clear, though the patient may be almost or completely blind, when the effects of the inflammation have extended to the choroides and retina.*

The *spurious purulent cataract* is much less frequent, than the lymph-cataract. In neglected cases of hypopium (*see this word*), where the pupil is already quite covered with pus, the greater part of the effused matter is sometimes absorbed, and the pupil can be seen again, but, immediately behind it, a quantity of coagulating lymph can be discerned as in the lymph cataract, sometimes even projecting partly into the anterior chamber, but blended with particles of purulent matter, so as to give it a light yellowish tinge, and a clustered appearance. The pupil is always diminished, adherent to the morbid substance, and angular; the motionless iris projects towards the cornea; and not only the eye-sight, but even the perception of light are completely lost, or the latter at least much diminished.

A rare variety of spurious cataract, described by Beer, is the *blood-cataract*. Either from some considerable injury of the eye, a large quantity of blood is extravasated in the chambers, and, slowly absorbed during the ophthalmia caused by the violence, a part of it, however, remaining in the posterior chamber in the form of small clots, encysted in the lymph, which was effused during the inflammation; or else in the course of a more tedious and neglected case of hypopium, blood is effused in the chambers of the eye, and, not mixing with the pus, still continues in the same form behind the pupil, after the matter has been absorbed. In the first example, this cataract looks like a reddish web, interwoven with silvery streaks, or threads; the pupil, though angular, is seldom contracted; the iris nearly, or quite motionless; and, not only is the light clearly distinguished, but a partial degree of vision sometimes retained. On the contrary, in the second instance, the opacity behind the pupil is very dense, white, studded with reddish, or brownish points, or specks, having a clustered appearance, and frequently projecting through the pupil into the anterior chamber; while the pupil itself is very small, and angular, the iris quite incapable of motion, and ge-

nerally either no perception of light remains, or only a very confined indeterminate sensation of it. Beer says, that this cataract may easily be mistaken for lymph, and that its differences can only be made out with a good magnifying glass.

The *dendritic cataract* of Schmidt, the *arborescent cataract* of Richter, or the *choroid cataract*; as Beer observes, is not one of the least frequent of the spurious cataracts, and is invariably the consequence of a violent concussion of the globe of the eye, with, or without a wound, whereby a portion of the tapetum of the uvea is loosened and becomes placed upon the anterior layer of the capsule, more or less resembling in its appearance the arborescent form of the stone termed a dendritis. Immediately after such a concussion of the eye-ball, the patient complains of a serious diminution and confusion of vision. Whoever examines the eye only superficially, will certainly not discern the pieces of the tapetum lying upon the yet perfectly transparent capsule of the lens, for the most careful inspection will be necessary for the purpose, and sometimes the aid of a magnifying glass will be requisite. But, as the lens and its capsule are mostly at the same time loosened from their connexions, they likewise generally become deprived of their transparency, and as soon as this has happened, the displaced portion of the tapetum can be readily seen. When inflammation ensues, the flakes of the tapetum become closely adherent to the front layer of the capsule of the lens, and even the pupillary edge of the uvea acquires the same kind of connexion, so that the perception of light is diminished. But, says Beer, when inflammation follows, the pupillary margin of the uvea remains free, the iris is perfectly moveable, the light clearly distinguishable, though the lens and its capsule be entirely opaque, and sometimes the flakes of the tapetum resembling the arborescent *streaks* of the dendritis alter in shape, size, and position, but never completely disappear, though they may not closely adhere to the capsule. (*Lehre von den Augenkr. B. 2, p. 303, 309.*)

Another classification of cataracts, which is of great importance to an operator, is that which is founded upon their consistence; for, as Beer remarks, this makes not only a great difference in the prognosis, but also in the choice of a method of operating.

When the opaque lens is either more indurated, than in the natural state, or retains a tolerable degree of firmness, the case is termed, a *firm*, or *hard cataract*. When the substance of the lens seems to be converted into a whitish, or other kind of fluid, lodged in the capsule, the case is denominated a *milky*, or *fluid cataract*. When the opaque lens is of a middling consistence, neither hard nor fluid, but, about as consistent as a thick jelly, or curds, the case is named a *soft*, or *caseous cataract*. When the anterior, or posterior, layer of the crystalline capsule becomes opaque, after the lens itself has been removed from this little membranous

sac, by a previous operation, the affection is named a *secondary cataract*.

The harder the cataract is, the thinner and smaller it becomes. In this case, the disease presents either an ash-coloured, a yellow, or a brownish appearance: According to Beer, its colour is very dark. The interspace, betwixt the cataract and pupil, is considerable. The patient distinctly discerns light from darkness, and when the pupil is dilated, can even plainly perceive large bright objects. In the dilated state of the pupil, a black circle surrounding the lens is very perceptible. The motions of the iris are free and prompt; and the anterior surface of the cataract appears flat, without any degree of convexity. (*Richter's Anfangsgr. der Wundarzn* p. 177. 3 B. Beer, Vol. cit. p. 309.)

Beer says, that it is only the genuine lenticular cataract, which can be hard, and it is chiefly met with in thin, elderly persons; but, with respect to the opinion, that all cataracts in old persons are firm, he says, this is frequently contradicted by experience. In cataracts, extracted from thin, aged individuals, the lens is sometimes found dwindled, as hard as wood, nearly of a chesnut-brown colour, and with its two surfaces as flat as if they had been compressed. This case has sometimes been denominated the *dark-gray cataract*, and is very difficult to make out previously to an operation, being liable to be mistaken for an incipient amaurosis. Hence, in order to judge of it effectually, the pupil should always be dilated with hyosciamus.

To the firmish, consistent kind, Beer refers several capsulo-lenticular cataracts, namely, the *encysted*, and *conical* or *pyramidal cataracts*, that to which he applies the epithet *dry husked*, the *gypsum cataract*, in particular, and the *bar-ataract*, which at least is always partly firm, as well as all the varieties of *spurious cataract* (Beer, B. 2, p. 309.)

The fluid, or milky cataract, has usually a white appearance; and irregular spots and streaks, different in colour from the rest of the cataract, are often observable on it. These are apt to change their figure and situation, when frequent and sudden motions of the eyes occur, or when the eyes are rubbed and pressed; sometimes, also, these spots and streaks vanish, and then reappear. The lower portion of the pupil seems more opaque than the upper, probably because the untransparent and heavy parts of the milky fluid sink downward to the bottom of the capsule. The crystalline lens, as it loses its firmness, commonly acquires an augmented size.—Hence, the fluid cataract is thick, and the opacity close behind the pupil. Sometimes one can perceive no space between the cataract and margin of the pupil. In advanced cases, this aperture is usually very much dilated, and the iris moves slowly and inertly. This happens because the cataract touches the iris, and impedes its action. The fluid cataract is

sometimes of such a thickness, that it protrudes into the pupil, and presses the iris so much forward, as to make it assume a convex appearance. Patients, who have milky cataracts, generally distinguish light from darkness very indistinctly, and sometimes not at all; partly, because the cataract, when it is thick, lies so close to the iris, that few or no rays of light can enter between them into the eye; partly, because the fluid cataract always assumes, more or less, a globular form, and therefore has no thin edge, through which the rays of light can penetrate. (*Richter's Anfangsgr. der Wundarzn*. 3 B. 174, 175.) Mr. Travers believes that fluid cataracts are rarely contained in a transparent capsule, and his experience has taught him, that this membrane is partially opaque, presenting a dotted, or mottled surface. The opaque spots are most distinguishable when viewed laterally. (*See Med. Chir. Trans.* Vol. 4, p. 284.)

According to Beer, a fluid cataract is mostly conjoined with a complete opacity of the capsule; its diagnosis therefore is commonly very difficult, and sometimes its nature cannot be known with certainty, until an operation is undertaken. When the capsule is opaque only in some places, he states, that the following circumstances may be noticed. The cataract lies close to the uvea, and when the patient inclines his head forwards, the cataract presses the iris towards the cornea, and the anterior chamber becomes evidently smaller; but, when he lies upon his back, the cataract recedes in some degree from the uvea. The power of distinguishing the light is decided. When the head is kept quiet for a long time, a thick sediment, and a thinner part can be plainly remarked in the cataract; during which state, that is, while the two substances are undisturbed, the patient can sometimes distinguish large well-lighted objects, as through a dense mist; but, when the head, or eye, is quickly moved, these two substances become confused together again, and the cataract again presents an uniform white colour. (Vol. cit. p. 312.) It cannot be denied, says Beer, that what is called the *congenital cataract*, and which presents itself in infants soon after birth, when their eyes have been exposed to immoderate light, is not unfrequently fluid; but in such cases it must not be presumed that the lens is always in this state; for, in fact, the cataract is often of that sort, which Beer describes under the name of *dry-husked*.

Sometimes the opaque lens is of a middling consistence, neither hard nor fluid, but about as consistent as thick jelly, curds, or new cheese. Cases of this description are termed soft or caseous cataracts. The consistence here spoken of, may be confined to the two surfaces of the lens, or may exist in its very centre. The first case is the most frequent. The diagnosis is not difficult; for, it always has a light gray, grayish white, or seagreen colour. When it is far advanced, it quite impedes the eyesight

and sometimes considerably interferes with the perception of light. (*Beer, B. 2, p. 310.*) As the lens softens in this manner, it commonly grows thicker and larger, even acquiring a much greater size than the fluid. It is not unfrequent to meet with caseous cataracts of twice the ordinary size of a healthy crystalline lens. The motions of the iris are very sluggish. (*Richter's Anfangsgr. der Wundarsen. p. 178. 3 B.*) Indeed, Beer says, that it is sometimes requisite to use the hyosciamus, in order to ascertain that no adhesions exist between the uvea and the cataract, for, in such cases, the posterior chamber is very often completely abolished, as the more caseous the lens is, the larger it is; and hence likewise the black ring at the edge of the pupil is not at all owing to the shadow of the iris, but entirely to the dark border of the iris, at the margin of that opening. According to Beer, the colour of such cataracts is never uniform, but more or less speckled; the spots, however, either have no determinate outline, or they seem like mother-of-pearl fragments, into which the cataract crumbles when extracted, or couched, or else they assume the appearance of clouds. (*Beer, B. 2, p. 311*) According to Mr. Travers, the caseous cataract has a heavy dense appearance, uniformly opaque, a clouded, not a fleecy whiteness, and sometimes a greenish, or dirty white tinge.—(*Med. Chir. Trans. Vol. 4, p. 285.*) He further states, that what he terms the *flocculent* or *fleecy*, and the *caseous*, or *doughy* cataracts, are most frequently met with; the *fluid*, or *milky* cases, and those called *hard*, being comparatively rare (*Op. et loc. cit.*) As Beer observes, a cataract, which is recent, and has originated suddenly, especially in young subjects, requires much more circumspection ere an operation is determined upon, than a cataract, which has already existed a long while, and the formation of which has been only gradual, particularly in an old subject: for, the first case is more frequently owing to a concealed slow kind of inflammation, than is generally supposed. (*Vol. cit. p. 314.*)

Cataracts are also denominated, *ripe*, or *unripe*; terms, which have often led to the error of supposing, that every cataract must ripen in time. A cataract is called *ripe*, as soon as it is in a state which will admit of no increase, whether the eyesight be completely lost, or only diminished, and whether the pupil be entirely occupied by it or not. Thus, says Beer, the *dry-husked cataract*, in its most advanced stage, never totally fills the pupil, and the patient can sometimes even discern colours; nor does the *floating capsular-lenticular cataract* fill the pupil in a greater degree; and yet both these cases are completely ripe for an operation. On the other hand, to the unripe cataracts belong the *central cataract of the capsule and lens*, the *posterior capsular cataract*, and the *slight degree of lymph-cataract*. Most of these unripe cataracts, after, perhaps, remaining for years in this state, not

unfrequently all on a sudden become complete, upon an accidental and slight attack of ophthalmia; but, sometimes, they remain unchanged during life. (*Beer, B. 2, p. 316.*)

Another very useful and practical division of cataracts is into those which are called *simple local*, and into others, which receive the name, of *complicated*. A *simple local* cataract is so denominated by Beer, when the patient is in every other respect perfectly healthy, and no disease prevails in any other part, however distant from the eye. A cataract may be *complicated* in three ways; for, it may be attended either with other simultaneous disease in the eye itself, or its appendages, when the case is termed a *local complicated cataract*; or there is some other disease prevailing in the system, either unconnected, or connected, with the production of the cataract, which then has the epithets *general complicated* applied to it; or, lastly, both descriptions of complication exist together, the *complete complicated cataract*.

Among the *local complicated* cases, is the *adherent cataract*. The preternatural cohesion may be one of the anterior layer of the capsule with the uvea, produced by effused lymph; it may consist in a very firm connexion of the posterior layer of the capsule with the membrana hyaloidea; or it may be an unusually close cohesion of the whole of the capsule with the lens; or, says Beer, all the three species of adhesion may exist together. (*p. 318.*)

The adhesion of the capsule of the lens to the uvea (*synechia posterior*) is generally obvious enough; for, as Beer has observed, the pupillary margin of the iris is not completely circular, and is more angular the stronger the light is. The cataract lies close to the uvea, and is very white. The motions of the iris are more or less obstructed, and, when the adhesion is extensive, are quite prevented. The perception of light is indistinct, often very faint, and sometimes entirely lost, for the preternatural adhesion is always the consequence of previous internal ophthalmia, which, besides occasioning opacity of the lens and its capsule, readily produces other serious effects upon the retina, the choroid coat, and vitreous humour, quite adequate to account for the loss of sight, and the incapacity of distinguishing the rays of light.—When the anterior layer of the capsule is adherent only at a single point to the uvea, the extent of the adhesion may be readily ascertained by artificially dilating the pupil with hyosciamus, or belladonna; and the information thus obtained, will have great weight in the selection of a method of operating. (*Beer, loco cit.*)

Some other local complications of cataract are so obvious, that they cannot fail to be understood; as, for instance, its combination with an adhesion of the iris to the cornea (*synechia anterior*); with closure of the pupil, unattended by any adhesion of the uvea to the anterior capsule of the lens

(*synechia posterior*;) as in watchmakers, and hysterical or hypochondriacal subjects, the complications with atrophy, hydrophthalmia, cirsophthalmia, specks and scars upon the cornea, pterygium, and various forms of ophthalmia.

According to Beer, the combination of cataract with glaucoma is also readily made out by any body who has once seen the case; for the cataract always presents a greenish, and sometimes quite a sea-green colour; it is of prodigious size, so as to project through the pupil towards the cornea; the colour of the iris is more or less changed, nearly in the same manner as after iritis; the iris is perfectly motionless; the pupil very much expanded and drawn into angles, for the most part towards the canthi; the lesser circle of the iris is nowhere visible, because it lies concealed under the far-projecting soft cataract; the light cannot be perceived, though the blinded patient is frequently conscious of false luminous appearances within the eye (*photopsia*;) and, lastly, the case is invariably accompanied with more or less of a varicose state of the blood vessels of the eye. The origin of this sort of cataract is constantly attended with severe, obstinate headach.

There are, says Beer, two other local complications, which are much more difficult to learn before an operation. The first is a cataract combined with a dissolution of the vitreous humour (*synchysis*), the diagnosis of which, indeed, when the affection prevails in a considerable degree, is tolerably easy, as the cataract trembles, and the iris always swings backwards and forwards upon the slightest motion of the eye-ball; the globe itself is somewhat affected with atrophy; the eye is quite spoiled, and feels flaccid and unresisting; the sclerotica, immediately around the cornea, is bluish, as in infants; and, the perception of light is uncertain. On the other hand, when the *synchysis* is not far advanced, the only symptoms are a suspicious softness of the eye-ball, and a swinging of the iris, when the eye is suddenly or violently moved.

The other complication of cataract, sometimes very difficult to detect previously to an operation, is amaurosis. When, indeed, the pupil is extraordinarily large, the iris nearly or quite motionless, and the patient cannot distinguish day from night, and, of course, not the least glimmer of light, no great powers of divination are required to predict with certainty, that no operation will restore the eyesight, which is abolished not by the cataract, but by the existing amaurosis. On the other hand, when the motions of the iris are nearly as free as in the natural state, the pupil as small as it usually is in a given degree of light, the patient capable of judging accurately of the strength of the light, and yet the cataract conjoined with amaurosis, which, with the exception of the faculty of perceiving the light, completely impedes vision, it is then only by a careful inquiry into the history of

the disease, that certain circumstances, attending the origin of the cataract, and indicating in some measure the prevalence of amaurosis, can be traced; sometimes in consequence of one eye being affected with amaurosis, and not with cataract, a reasonable suspicion may be deduced, that the eye with cataract is also amaurotic; yet, says Beer, in such a case, nothing certain can be known before an operation is done.

As the same author observes, the general complications of cataract are as numerous as the diseases of the constitution itself, or as the affections of other organs, besides the eye; but the most common are scrophula, gout, syphilis, psora, old ulcers of the leg, and an unhealthy constitution.

CAUSES; PROGNOSIS; &c.

Persons, who are much exposed to strong fires as blacksmiths, locksmiths, glassmen, and those who are engaged in similar employments, are deemed to be more subject to the cataract than others. Persons above the age of forty, are reckoned more liable to cataracts than younger subjects. (*Wenzel*.) The disease, however, is by no means unfrequent in the latter; even children are often seen affected with this kind of blindness, and some are born with it. Beer assents to the general correctness of the opinion, that old age is conducive to cataracts, since the disease is most frequently observed in old persons. Yet, says he, that age, nay a very great age, cannot be deemed a regular cause of cataract, is clear from the circumstance of many very old, and even decrepit, individuals being able, with the aid of spectacles to read the smallest print; and it would seem, that other causes, besides old age, are essential to the production of cataracts; as, for instance, immoderate exertion of the eye during youth, particularly in such employments as expose the organ to a strong reflected light. (*Lehre von der Augenkr. B. 2, p. 325.*)

Among the circumstances which promote the formation of cataracts, Beer enumerates rooms illuminated only by reflected light; and all kinds of work, in which the eyes are employed upon shining, small, microscopic objects, especially when, during such labour, a determination of blood to the head and eyes is kept up by the compressed state of the abdomen, the cataract often seeming to come on more or less quickly with inflammation of the capsule, and lens. And, according to the manifold experience of the same author, one of the most important, though least noticed, causes promoting the formation of cataract, is allowing very strong light suddenly to enter the eyes of a new-born, or very young delicate infant, the consequence of which is, that cataracts form more or less quickly with inflammation of the capsule and lens, or remain for life incomplete, as is the case in the central capsular-lenticular cataract. The habitual vision of minute objects, in a

depending position of the head, by which an undue proportion of blood is said to be thrown upon the organ, frequently brings on cataracts. (See *Medico-Chir. Trans. Vol. 4, p. 279.*) In the majority of instances, a cataract seems to arise spontaneously, without any assignable cause. Sometimes the opacity of the lens is the consequence of external violence; a case, which, more frequently than any other, gets well without an operation.

Frequently (says a modern writer) the cataract "proceeds from a hereditary disposition, which has existed for several successive generations; while, in other cases, it attacks several members of the same family, without any disposition of this kind being recognizable in their progenitors. Among others, Janin mentions a whole family of six persons, who laboured under this disease. (*Obs. sur l'Oeil, p. 149.*) Richter extracted the cataract from a patient, whose father and grandfather had been affected with the same malady, and in whose son, at that period, it had begun to manifest itself. He adds, that he had seen three children, all born of the same parents, who acquired cataracts at the age of three years. (*On the different kinds of Cataract, p. 3.*) "During my apprenticeship with the late Mr. Hill, of Barnstaple, I was present when he operated on two brothers, and a sister, all of whom were adults, and who stated, that three or four others of their family were affected with symptoms not unlike those which they had experienced at the commencement of the complaint. I myself recently operated on two gentlemen advanced in years, who informed me, that they had a brother, on his return from India, who was similarly affected." (See *Adams's Pract. Observations on Ectropium, Artificial Pupil, and Cataract, p. 101. London, 1812.*) Beer also speaks of families, in which the children all became afflicted with cataracts at a certain age; cases, says he, where an operation, though done by the most skilful practitioner, hardly ever succeeds. (*Lehre von der Augenkr. B. 2, p. 331.*)

Long exposure of the head and eyes to the rays of the sun, together with a bent position of the body, as in some kinds of field labour, and the drinking of new acid wines, are reckoned by Beer as causes promoting the formation of cataracts on the approach of age; also hard labour near strong fires, as near ovens and forges, in glass houses, &c.; and hence, it is not unfrequent for smiths, cooks, &c. when they are advanced in years, to be afflicted with cataracts.

Beer says, that he has also learned from repeated observation, that exposing the eye to the vapour of concentrated acids, naphtha, and alcohol, will sometimes bring on a cataract; a statement, which will be received in this country with some hesitation, where the vapour of ether has been occasionally recommended for the dispersion of opacities of the lens and its capsule. The

dust of lime is also supposed to be conducive to the disease, cataracts being said to be frequent among the workmen in lime pits and kilns.

Wounds of the eye, where the weapon has pierced the capsule and the lens, and especially violent concussions of the forepart of the globe of the eye, though no wound may exist, are in general followed by a cataract, as an immediate consequence. This is the case, says Beer, even when no inflammation arises from the injury, the cataract often occurring in a few hours, and in so considerable a degree as not to admit of being mistaken.

The cause of cataract thus rapidly produced, must depend, in Beer's opinion, upon the complete separation of the lens, from its connexions with the capsule, and not unfrequently in part upon the detachment of the capsule itself from the neighbouring textures; for, in such cases, this membrane also gradually becomes opaque.

According to Beer, cataracts frequently arise from a slow, insidious, inflammation of the lens and its capsule.

With respect to the prognosis, it must be evident from what has been premised, that there are many cataracts in which the cure is highly problematical, and others, in which the impossibility of restoring vision, even in the slightest degree, may be predicted with absolute certainty.

With the little positive information which surgeons possess concerning the causes of cataracts, scarcely any expectation can ever be entertained of curing opacities of the lens and its capsule, by means of medicine, so as to supersede all occasion for an operation. A possibility of success, as Beer remarks, can exist only when the cause of the cataract is ascertained, admits of complete removal, and the disease is in an early stage. And he has learned from manifold and repeated trials, that the attempt to cure an incipient cataract will never succeed, except when some determinate and obvious general or local affection of a curable nature has had a chief share in the production of the disease of the eye; as, for instance, serophula in a mildish form, syphilis (?) and the sudden cure of eruptions, or old ulcers of the legs, (?) or a slow insidious inflammation of the iris and capsule of the lens. In some examples of this kind, Beer could only check the further progress of the cataract, and, even when the eye sight was improved, it was never rendered perfectly clear. And when the cataract was far advanced, and quite developed, with the exception of the general melioration of the health, and an improved state of the eye, whereby it was put in a better condition for the operation; not the slightest benefit was derived from medicine. (*Lehre, &c. B. 2, p. 333.*)

The principal external remedies that have been tried for the cure of the cataract, are, bleeding, cupping, scarifying, setons, issues, blisters, and fumigations; and the chief internal remedies are aperients, emetics, ca-

thartics, sudorifics, cephalics, and sternutatories. Preparations of eye-bright, millepedes, wild poppy, henbane, and hemlock, were some years ago credulously commended as specifics for the disorder.

Scultetus asserts, that he checked the progress of a cataract, by applying to the eye the gall of a pike, mixed with sugar; and Spigelius boasted of having successfully used, for this purpose, the oil of the eelpout (*mustela fluviatilis*.)

Cataracts are said to have been cured in venereal patients, while under a course of mercury. Probably, however, many such cases might have been mere opacities of the cornea, which had been mistaken for cataracts. Wenzel placed no reliance whatever on the power of any remedies to dissipate a cataract, and, as he had remarked their inefficacy in numerous instances, he felt authorized in declaring, that internal remedies, either of the mercurial, or any other kind, are inadequate to the cure of this disorder; and equally so, whether the opacity be in the crystalline, or in the capsule, whether incipient, or advanced.

Although the late Mr. Ware coincided with Wenzel and Beer, in regard to the uncertainty of all known medicines to dissipate an opacity, either in the lens, or its capsule, or even to prevent the progress of such opacity, when once begun, yet according to his observations, many cases prove, that the powers of nature are often sufficient to accomplish these purposes. The opacities, in particular, which are produced by external violence, Mr. Ware had repeatedly seen dissipated in a short space of time, when no other parts of the eye had been hurt. In such cases, the crystalline lens is generally absorbed, as is proved by the benefit which is afterwards derived from very convex glasses. In some of these cases, though the crystalline had been dissolved, the greater part of the capsule remained opaque, and the light was transmitted to the retina only through a small aperture, which had become transparent in its centre. Instances are also not wanting, in which cataracts, formed without any violence, have been suddenly dissipated in consequence of an accidental blow on the eye. The remedies which Mr. Ware found more effectual than others, were the application to the eye itself of one or two drops of ether, once or twice in the course of the day, and occasionally rubbing the eye, over the lid, with the point of the finger, first moistened with a weak volatile, or mercurial liniment. But, as Beer observes, the operation is now regarded almost as the only means affording any rational hope of restoring the eyesight of patients afflicted with cataracts.

Notwithstanding also the perfection to which the operation, with all its different modifications, is really brought, its performance will not always re-establish vision; nay, says Beer, it is frequently counterindicated; and, even in favourable cases, the result of the operation is exposed to so many contingencies, that it is rather a mat-

ter of surprise, that, on the whole, so much success should attend it as is found to happen.

When an operation for a cataract is done apparently under favourable circumstances, and its event is unexpectedly very incomplete, or quite unsuccessful, surgeons in vain ascribe the failure to the method of operating, which they have hitherto adopted, and uselessly abandon it for another; because none of these methods, including that which is preferred, brought to the highest state of perfection possible, can be applicable to all cataracts. But, says Beer, the reason of the ill success is generally rather owing to the operation not having been indicated, or to a mode of operating not well calculated for the particular case having been selected. He ridicules the idea of adhering exclusively to any one plan of operating; and, whenever the question is put to him, what is his own plan? he answers, that his custom is to operate in the manner which appears to him to be best adapted to each particular case, about which he is consulted. A surgeon should be able to distinguish, first, the cases of cataract, in which an operation may be done with the best chance of success; secondly, the examples, in which the prognosis is more or less doubtful; and, lastly, the cases, in which there is a great probability, or an absolute certainty, of the operation failing, in which last circumstance the practice is prohibited.

According to Beer, the result of an operation will probably be favourable; 1. When the cataract is a genuine local complaint, perfectly free from every species of complication. 2. When the conformation of the eye and surrounding parts is such, as to allow whatever method of operating may be most advantageous for the particular case, to be done without difficulty. 3. When the patient is intelligent enough to behave himself, in a manner, which will not disturb the precision and safety of the requisite proceedings in the operation, or the subsequent treatment. 4. When the operator, not only possesses all requisite medical and surgical knowledge in general, but is capable of judging correctly, what method of operating suits the particular case; and when besides he has derived from nature and acquisitions such mental and corporeal qualities, as are essential to a skilful operator on the eye; viz. an acute eyesight, a steady, but light, skilful hand, excellently qualified for mechanical artifice in general; long, pliant fingers; a delicate touch; a certain tenderness in the scientific treatment of this particular organ; complete fearlessness; invincible presence of mind; and proper circumspection. 5. When the requisite instruments are not too complicated; but well adapted to the purpose, and in right order. 6. When the domestic condition of the patient is such as not to occasion any particular disadvantages during, or after the operation. Yet, says Beer, even with this fortunate combination of circumstances, uniform success must not

be expected after operations for cataracts ; for a patient, whose sight is quite prevented by this disease, and who previously to its origin, was already far-sighted, will be still more so after the removal of the diseased lens, and in order to see distinctly the most common objects which are near, he will be obliged constantly to employ suitable glasses. An individual of this description, though the operation be done with great success, is apt not to be satisfied. But, such patients as were short sighted previously to the formation of their cataracts, are more pleased with the restoration of vision ; as, before the operation, their eyesight was much less than what it is now, and, in general, they can lay aside the glasses, which they formerly made use of, without having occasion for any others. Lastly, as Beer remarks, although patients, who, before the origin of their cataracts, were neither far nor short-sighted, are sensible of the important benefit of an operation, inasmuch as they now plainly discern all objects again, yet, they are usually obliged to employ spectacles in reading, writing, or doing any kind of fine work.

On the other hand, the result of an operation Beer considers always more or less doubtful ; 1. When the cataract is only locally complicated, as, for instance, with pterygium, which may not form any absolute reason against the experiment. 2. When the conformation of the eye and surrounding parts, causes several hinderances to the operator ; as is the case, when the eye is small, and deep in the orbit, and the fissure of the eye-lids very narrow. 3. When the patient is either very stupid, and obstinate ; rough mannered ; particularly timid ; or badly fed. 4. When the surgeon knows how to operate only in one way, in which, perhaps, he has also not had sufficient experience, and when possibly he is also deficient in the qualities specified above, as essential to a good operator on the eyes. 5. When the instruments are bad. 6. When in the patient's domestic affairs, there are any circumstances which cannot be removed, and are likely to have a bad effect upon the operation, as an unwholesome, damp room, great uncleanness, &c. 7. When the origin of the cataract was attended with repeated, or tedious headach, though this may have subsided a long while. 8. When the patient is particularly subject to catarrhal and rheumatic complaints, especially affecting the eyes. 9. When the patient has often had, or still labours under an attack of erysipelas, notwithstanding the parts inflamed be remote from the eye. 10. When the patient's skin is peculiarly irritable. 11. When in his childhood, or youth, he has been frequently afflicted with convulsions, or epileptic fits, though these complaints may have ceased many years. 12. When there is the least tendency to certain constitutional diseases, scrophula, gout, syphilis, &c. Gout, however, does not always make an operation fail, as we learn from Mr. Travers, who, in three cases, ex-

tracted the cataract from gouty subjects, and, though a smart attack of the disease followed the operation, the eyes were unaffected, and the sight was well recovered. (*Synopsis of the Diseases of the Eye*, p. 297.) 13. When the patient's habit is bad, though not affected with any definite disorder. 14. When the patient in his youth has often been troubled with attacks of ophthalmia. 15. When he cannot perceive the different degrees of light, and correctly describe them, while nothing to account for this state can be detected in the eye itself. 16. The result of an operation is always very doubtful, when there is the slightest tendency to hysteria ; or hypochondriasis. 17. When the patient is subject to violent mental emotions, mania, &c. 18. When the eye to be operated upon can still discern things, however feebly, a state, which generally produces an involuntary resistance, to the necessary measures in the operation. 19. When the cataract is the consequence of a wound, though free from complication. 20. When the patient is in the state of pregnancy. 21. When one eye has been already destroyed by suppuration. 22. And lastly, when one eye has already been operated upon without success, by a man, whose professional judgment, skill, and caution, are unquestionable.

According to Beer, the result of the operation will be more or less unfavourable ; 1. When the patient is affected with gutta, or acne rosacea, not the effect of hard drinking, but rather of scurvy. 2. When evident traces of some general disease of the constitution are present. 3. When the patient has been ill, and is only yet convalescent. 4. When any other disease, though not constitutional, is present. 5. When the cataract is adherent for a considerable extent to the uvea, or an incurable, though not very severe chronic inflammatory affection of the eye-lids, or eye-ball, prevails, as, for instance, an habitual inflammation of the Meibomian glands ; ectropium of the lower eye-lid ; the remains of a pannus ; or, a strong aversion to light.

Lastly, as Beer observes, every operation must fail, when the cataract is manifestly joined with complete amaurosis, a dissolution of the vitreous humour, dropsy, or atrophy of the eye, some species of ophthalmia, glaucoma, or a general varicose affection of the blood vessels of the eye.

The capacity of distinguishing light from darkness, and, in a shady place, where the pupil is not too much contracted, of perceiving bright colours and the shadows of objects, is, as Scarpa has particularly noticed, a very important desideratum in every case, selected for operation.

The power of distinguishing light from darkness, is even more satisfactory, than motion of the iris. I saw many years ago, in St. Bartholomew's and the York hospitals, several cases of complete gutta serena in both eyes, in which there was the freest contraction and dilatation of the pupils. Had such patients been also afflicted with

cataract (a complication by no means unfrequent) and a surgeon, induced by the moveable state of the iris, had undertaken an operation, it must of course have proved unavailing, since the rays of light could only have been transmitted to an insensible retina. Richter, and Wenzel, make mention of these peculiarities, and the latter refers the phenomenon to the iris deriving its nerves wholly from the lenticular ganglion, while the immediate organ of sight, is constituted entirely by another distinct nerve. Hence, motion of the iris is not an infallible criterion, according to several authors, (*Wathen*) that the retina is endued with sensibility. Relating to this subject, Mr. Lucas has made a curious remark: he attended, in conjunction with Hey and Jones, five children of a clergyman at Leaven, near Beverley, who were all born blind. He writes, "None of them can distinguish light from darkness, and, although the pupil is, in common, neither too much dilated nor contracted, and has motions, yet these do not seem to depend upon the usual causes, but are irregular." (*Med. Obs. and Inq. Vol. 6.*)

The reciprocal sympathy between the two organs of sight, is so active, that no one, solicitous to acquire either physiological or pathological knowledge respecting them ought, for a moment, to forget it. Hence, in the examination of cataracts, it is of the highest importance to keep one eye entirely secluded from the light, while the surgeon is investigating the state of the iris in the other; for, the impression of the rays of light upon one eye, sensible to this stimulus, is known to be often sufficient to produce corresponding motions of the iris in the opposite one, although in the state of perfect amaurosis. In other examples of cataract, the pupil may be quite motionless, and yet sight shall be restored after the performance of an operation. (*Wenzel*.) There are two circumstances, however, which may prevent us from ascertaining, whether the retina is sensible to light or not: the first is, a circular adhesion of the crystalline capsule to the iris. Here Richter thought, that some opinion might be formed of the nature of this case, by observing the distance between the cataract and pupil: inferring, that when the space, between the pupil and opaque lens, was inconsiderable, such an adhesion had happened; and, when the cataract did not seem particularly close to the pupil, and yet the patient could not discern light from darkness, that it was complicated with amaurosis. The second circumstance, sometimes utterly preventing the ingress of any light to the healthy retina, is the round bulky form of the cataract.

But, although the power of distinguishing light from darkness is more satisfactory, than motion of the iris, it is not an unequivocal test of the retina being perfectly free from disease. While the gutta serena is incomplete, the patient can yet distinguish light, and the shadows of objects. Dilatation of the pupil is, also, a deceitful criterion of the

complication of gutta serena with the cataract. When the cataract is large, or adherent to the iris, the pupil is frequently much dilated, however natural and sound the state of the optic nerve may be: the pupil often continues quite undilated in a perfect gutta serena. (*Richter*.)

From all this it must be manifest, 1st, that the irregularity, and inconstancy of the symptoms of gutta serena, together with the possibility of particular states of the cataract rendering the patient utterly unconscious of the stimulus of light, make it necessary for the surgeon to be particularly attentive to the appearance, and to the history of the origin and progress of the disease, in order to understand the real condition of certain cases. 2d, That when the patient can distinguish light from darkness, though the iris may be motionless, there is good ground for trying an operation. Possibly, in this circumstance, an incipient amaurosis may exist, but, the chance of the defect of the iris arising from other causes; the certainty, that the opaque body must be removed from the axis of sight, (even if the disease of the retina be cured,) ere sight can be restored; and the improbability, that an operation to cure the cataract, will render the other complaint at all less remediable; fully justify the attempt. Frequently, the patient has a full formed cataract in one eye, which presents the signs of amaurosis, while an incipient cataract, or one as much advanced, exists in the other, which, at present, is free from these symptoms: in this case (says Mr. Travers,) the cataract of the latter should be removed, without delay. (*Synopsis, &c. p. 314.*)

The concurrent testimony of almost all writers upon the subject tends to prove that the restoration of sight has sometimes been effected in the most hopeless cases, and I am, therefore, of opinion with Mr. Lucas, that in all doubtful cases, an operation should be tried as a remedy, by no means violent or hazardous. (*Med. Obs. and Inquiries, Vol. 6, p. 257.*)

I shall conclude this part of the subject, with annexing the sentiment of Mr. Travers, viz. that it would be incorrect to say, that the operation is unadvisable in all cases of cataract, in which the patient has no sense of light; for, it is possible, that the density of the lens may be such as absolutely to exclude the light, and that the motions of the iris may be therefore suspended; or from some degree of pressure of the lens, or adhesion of the uvea to the capsule, that the pupil may be undilated, and the circumference of the lens permanently covered. But, undoubtedly, says Mr. Travers, a case of this description is unpromising. "A strong sense of light, by which at least to know the direction, in which it enters the apartment, to be sensible of its falling on the eye, and of a shade, as the hand for example, intercepting it, with a corresponding freedom of motion of the pupil, is the most favourable state for the operation." (*Synopsis of the Diseases of the Eye, p. 315.*)

As it not unfrequently happens, that cataracts, produced by external violence, spontaneously disappear, (*Pott, Hey, &c.*) the operation should never be too hastily recommended for such instances.

Respecting the question, whether an operation ought to be done, when only one eye is affected with cataract, and the other is sound, I find some difference of opinion prevails.

One reason assigned by the condemners of this practice, viz. that one eye is sufficient for the necessities of life, is but of a frivolous description; and, another, that the patient would never be able to see distinctly after the operation, by reason of the difference of the focus in the eyes, is, (I have grounds for believing) only a gratuitous supposition, inconsiderately transmitted from one writer to another. In support of what I have here advanced, and to prove that success does sometimes, probably in general, (if no other causes of failure exist,) attend the practice of couching, and extraction, when only one eye is affected with a cataract, I shall first adduce a fact from Maitre Jan. (*Traité des Maladies de l'Oeil. Edit. Paris, 1741, 12mo. Obs. sur une Cataracte laiteuse, p. 196.*)

"Le 17 Octobre de l'année 1785. J'allai à Savière pour abaiser une cataracte dans l'œil gauche d'un jeune garçon appelé Nicolas Very, valet de Sebastian Coutan, laboureur. Cette cataracte me paroissoit d'une bonne couleur, la pupille se dilatoit lentement, et beaucoup, et se resserroit de même, quand je passois la main entre l'œil et le grand jour, le sain étant fermé," &c. After describing the operation, he continues, "Quelques jours après je retournai le voir, et je trouvai que l'humeur aqueuse étoit fort éclaircie, et qu'il distinguoit toutes sortes d'objets: je le vis encore sept ou huit jours après en passant par son village, et je le rencontrai faisant son ouvrage, et entièrement guéri, sans qu'il parût qu'il eût jamais été incommodé de cataracte."

Baron Wenzel was in the habit of extracting cataracts with the most successful result, when only one eye was affected with the disease, as may be learnt by referring to the cases here specified. (*Cases 6, 13, 16, 19, 22, 25, 29, 30, 31, 34, &c. Treatise on the Cataract.*) It will be necessary to quote here only two cases, related by this eminent oculist. "Madame Harvey, a tobaccoconist, at Chalons sur Marne, presented a complicated case similar to the preceding. She had a cataract in the right eye, combined with an opacity in the anterior portion of the capsule, as appeared by the white spots and inequalities of which I have spoken above, in the surface of the crystalline.—Her left eye was sound. I operated on the right eye in the year 1782, &c. The patient suffered some pain in consequence of the operation, but was soon removed by bleeding her in the foot; and notwithstanding this obstacle, the sight was soon recovered to as great a degree of perfection as was

possible after such an operation." (*Wenzel on the Cataract, p. 138, Case 16.*)

The following case is as explicit as possible on the point under consideration. "A poor woman, de la Ferté sous Jouarre, who had a cataract in the right eye upwards of ten years, came to consult me in the year 1780. I found all the symptoms of the case favourable to an operation," &c. (after describing the manner of doing it, he continues;) "I immediately bound up, not only the eye that had undergone the operation, but the sound one also; a precaution, which it is necessary to use after all operations on the eye, even the most simple; it being almost impossible, that one eye should not follow the motions of the other, &c. In a fortnight she was perfectly cured; and, though the pupil remained larger than it was before the operation, or than that in the left eye, and had much less motion, yet this eye, as well as the other, perceived objects very distinctly." (*Case 22, p. 166.*) In the Medical and Physical Journal for May 1808, I have read an ingenious paper, defending the practice of operating, when only one eye is affected.

I next proceed to notice what Richter has remarked upon this head. He was formerly convinced, that the advice not to operate, when there is a cataract only in one eye, ought, for several reasons, to be disregarded; he reminds us of the wonderful consent between the eyes, so that one is seldom diseased without the other, sooner or later, falling into the same state; and hence he questions whether it may not be possible to prevent the loss of the sound eye by a timely operation? *An non caveri possit jactura integri oculi tempestive extrahendo cataractam prioris?* (*Obs. Chirurg. Fascic. 1.*) He adverts to the remarkable case related by St. Ives, where a man was wounded in the right eye by a small shot, and, shortly afterwards, had a cataract in it; he then gradually became blind in the left, but soon recovered his sight in it, after the cataract had been extracted from the right one. Here let us notice, that St. Ives (*Maladies des Yeux, Chap. 15, Art. 3.*) makes no mention of any confusion in vision, in consequence of the different refracting powers of the two eyes in question. Another reason, judiciously assigned by Richter, (*Obs. Chirurg. Fascic. 1.*) for disregarding the above precept, is, that in waiting until a cataract forms in the other eye, the existing one, which is at this moment, perhaps, in the most favourable state for the operation, may soon change so much for the worse (for instance it may contract such adhesions to the iris,) as either to destroy all prospect of relief, or, at most, afford but a very precarious and discouraging one. The length of time necessary to wait is also uncertain and tedious. I once saw a man in St. Bartholomew's Hospital, who had had a cataract in one eye fifteen years, during all which time the other continued quite sound; and another case of twenty

years standing has lately been communicated to me. It is right to state, that Richter latterly inculcated a contrary opinion to what he formerly espoused, yet, without specifying the particular facts which induced him to revoke his former sentiments. The principal reason stated by him is, that the patient not only does not see much more acutely with the two eyes after the operation, than with one before it, but, he frequently sees more confusedly, because the eye that has been operated on, cannot see well without the aid of a glass, which, perhaps, the sound one does not require. (*Anfangsgründe der Wundarzn. Dritter B. p. 199.*)

When I remember that no cases are adduced by this author to contradict the rationality of his former sentiments; when I also reflect upon the facts recorded by Maitre-Jan, St. Ives, and Wenzel; when I contemplate that Callisen mentions, as the feeble ground of his adopting the common opinion, that, in one single instance of this description, he was unsuccessful, without particularizing from what immediate cause the failure arose; there appears to my mind strong cause to believe, that the advice, not to operate, when there is only one cataract, and the other eye is perfect, is at least a subject which merits further investigation. Warner's objection is similar to that specified by Richter: he writes, "the eye, from which the crystalline lens is removed, cannot be restored to a degree of perfection at all equal to that of the sound eye, without the assistance of a convex glass;" (*Description of the Human Eye and its Diseases, p. 85.*) but, is not the power of using both eyes at the same time, even with the inconvenience of being necessitated to employ a glass for the purpose, preferable to being blind of one? The cases quoted, at all events prove, that confusion in vision is not always the result of the practice: whether the fact is concordant with the modern theory of vision, is entirely another consideration; if it should be found incompatible with it, we must infer, that our knowledge of optics still continues imperfect; not that such well-attested examples as some alluded to, are unworthy of belief.

When there is a full-formed cataract in one eye, and vision is retained in the other, Mr. Travers thinks the postponement of the operation wrong. "I am satisfied, (says he) that the cataractous eye, if it becomes the subject of an accidental inflammation, is strongly disposed to go into amaurosis; and, further, that the retina loses its vigour by the permanent exclusion of light, I speak from repeated observation of the fact. The objection to the operation on the ground of inconvenience, arising from the difference of focus of the two eyes, when one only is the subject of disease, is trivial, and a consideration altogether subordinate: such a defect may always be remedied by glasses properly adjusted. In several cases of amaurosis, ensuing upon cataract, I have been disposed

to regard the change in consistence and volume of the lens, as productive of a destroying inflammation; in others, of a partial absorption of the vitreous humour."—(*Synopsis of Diseases of the Eye, p. 313.*)

For some decided information on the foregoing interesting question, I have referred to Beer; but he seems not to have entered into its consideration at all. The only instance in which he approaches the subject, is, when he notices the custom of covering the eye, which yet possesses more or less vision, when the other alone has a cataract in a fit state for an operation.—(*Lehre von den Augenkr. B. 2, p. 351.*)

The reason which has induced me to allot so much space for the consideration of the question, whether an operation should be undertaken, when only one eye is affected, is a conviction of the importance of the decision made about it. Were I to judge only from what has been said by writers, I should be confident, that a determination in the negative must be erroneous; but, when I know that my experienced and judicious friend Mr. Lawrence joins in the belief, that the practice is not productive of advantage, the only inference which I venture to make, is, that the subject deserves further experiment.

When there are cataracts in both eyes, most authors are of opinion, that there is no reason why one should not be operated upon immediately after the other. As, however, the ophthalmia is likely to be more severe, *ceteris paribus*, when both eyes are operated upon at the same time, Scarpa, who gives the preference to the needle, disapproves of this mode of proceeding, and assures us, that, in patients with cataracts in both eyes, his experience has taught him, that it is by no means advantageous to operate upon one immediately after the other; but that it is better to wait till one eye is well, before any attempt is made upon the other. (*Saggio di Osservazioni, &c. p. 255.*)

On this point, the following is Beer's sentiment:—When cataracts are completely formed in both eyes, the patient willing, and every thing promises a favourable result, both eyes may be operated upon at the same time. On the contrary, when any circumstances are present, which render the event of the operation very doubtful, it is most advisable to make the attempt only on one eye, even though the patient absolutely wish more to be done, so that if the first operation should fail, but the complication of this cataract afterwards change considerably to the advantage of the patient, one eye would still be left for a second more favourable attempt. (*Lehre von den Augenkr. B. 2, p. 350.*)

Some years ago, it was the common doctrine, that no operation should be undertaken for a cataract, before the patient had attained the age of docility and reason, and, in a point of view abstractedly surgical, there can be no doubt of the rectitude of such advice; but, when it is further considered, how essential sight is to the acquirement of

education; that youth is the condition best adapted for this indispensable pursuit; that when the child's head is steadily fixed, the needle admits of being employed; that, with the aid of an assistant, this object can most effectually be accomplished; that, when the operation is delayed, the cataract may acquire adhesions; that, persons have not only had cataracts successfully depressed or broken, at a very early age, but with the assistance of a *speculum oculi*, have even had them extracted, (See *Ware's Note*, p. 90, of *Wenzel's Treatise*), which is universally acknowledged to be a far more difficult process; and that the pupil of the eye in a young subject, is nearly as large as in an adult; (*Warner's Description of the Human Eye and its Diseases*, p. 34.) I cannot help thinking with Mr. Lucas, that after a child is old enough to bear an operation, the attempt to cure a cataract with the needle *may be proper* at any age. Surgeons do not refuse to operate for the hare-lip, as early as two years of age; they do not wait for docility and reason in the patient, to make him manageable, and sensible of the propriety of submitting quietly to the performance of the operation; they render him tractable by force, and thus they wisely succeed in making perhaps, with more certainty, than reliance upon the fortitude of any human being would afford, a very precise incision, such as the nature of the operation demands; and, why should they refuse to attempt the cure of cataracts, in children, when the motives are more urgent, and it is equally in the power of art to substitute means, quite as effectual as docility and reason in surgical patients? What experienced operator would trust to these qualities, when he undertakes any grand operation, even on the most rational and firm adult? (*Critical Reflections on the Cataract*, 1805.)

Of late years, the attention of surgeons has been much drawn to the subject of operating on the cataracts of children, and the propriety of the practice seems to be now firmly fixed on the basis of experience. It is even ascertained, that the needle may be successfully employed on children of the most tender age. The late Mr. Saunders, surgeon to the London Infirmary for curing diseases of the eye, may be said to have had the principal share in promoting the adoption of this important improvement. His practice confirmed, what reason had long ago made probable, and the judgment, tenderness, and skill, with which he operated on the eyes of infants, as well as those of adults, were followed by a degree of success, which had never been previously witnessed, and which infused quite a new spirit into this most interesting branch of surgery. Subjects from eighteen months to four years old, received most benefit from Mr. Saunderson's operations; and, if any intermediate time be selected, Dr. Farre (the editor of this gentleman's publication) is inclined to recommend the age of two years. "The parts have then attained a degree of

resistance, which enables the surgeon to operate with greater precision, than at an earlier period; yet, the capsule has not become so tough and flexible, as it does at a later period, after the lens has been more completely absorbed.

"But, this is not the greatest, although a considerable advantage of an early operation; for, in cases, in which the patient has no perception of external objects, the muscles acquire such an inveterate habit of rolling the eye, that, for a very long time after the pupil has been cleared by an operation, no voluntary effort can control this irregular motion, nor direct the eye to objects with sufficient precision for the purpose of distinct and useful vision. The retina too, by a law, common to all the structures of an animal body, for want of being exercised, fades in power. Its sensibility, in many of the cases, cured at the ages of four years, and under, could not be surpassed in children, who had enjoyed vision from birth; but, at eight years, or even earlier, the sense was evidently less active; at twelve, it was still more dull; and from the age of fifteen and upwards, it was generally very imperfect, and sometimes the mere perception of light remained. But, these observations do not apply to those congenital cataracts, in which only the centre of the lens and capsule is opaque, the circumference being transparent, for, in those, the retina is exercised by a perception, although an imperfect one, of external objects, the motions of the muscles, which direct the globe, are associated, and an absorption of the lens does not take place: therefore, in this variety of the disease, the argument in favour of an early operation, is not so much a medical, as a moral one—it is preferable for the purposes of education and enjoyment." (*Saunders on Diseases of the Eye*, p. 153, 155.)

Besides Mr. Saunders, several other surgeons of the present day have become zealous advocates for operating upon the cataracts of children. Even Mr. Ware, before his death, strongly recommended the use of the needle in the congenital cataract of infants and children. His mode of operating I shall hereafter notice. The late Mr. Gibson, of Manchester, likewise urged the propriety of couching young subjects, and fixed on the age of six months, as preferable to that of two years. "Whatever objections (says he) have been urged against the safe and effectual use of the couching needle in infants, have always appeared to me so slight, and so easily surmountable, that, without inquiring particularly into the real state of the question, I have long concluded, that the same motives, which would induce an operator to couch a cataract at any period of adult life, would equally lead him to perform that operation at any earlier period, when a cataract existed. Acting upon this presumption, I have operated upon children of all ages, for ten years past." (*See Edinb. Med. and Surgical Journal*, Vol. 7, p. 394.)

Mr. Gibson's paper being dated June, 1811, we are of course given to understand, that he pursued this practice from the year 1801, and he asserts, that his experience had embraced a considerable number of cases.

"In performing the operation of couching infants, it has always appeared to me, (says this gentleman) that the advantages to be gained by restoring vision at so early a period, are so important, as to bear down any obstacles which may occasionally be opposed to the safe use of the needle. Even the risk of deranging the figure of the pupil forms no solid objection to its use; and may always be avoided by steadiness and good management. Should even a slight change in its figure be produced, it is seldom in the least detrimental to distinct vision, and can scarcely be considered a blemish in the eye of any one; except, perhaps, in that of a geometrician; who may easily reconcile to himself the presence of an oval opening, where one of a circular form should exist. It may farther be observed, that, if an operator cannot depend upon his management of the eye, so as to render it steady by the introduction of the couching needle, he can avail himself of the assistance of a speculum to restrain its motions.

"The following observations will apply principally to infants under twenty months old. The advantages, which an operator possesses, in operating upon a child of this age, as compared with a child of three years old, or upwards, are important. An infant is not conscious of the operation intended: it is free from the fears created by imagination, and can oppose very feeble resistance to the means employed to secure it with steadiness. At an early age, it has not acquired the power of retracting the eye deep in the socket, so that the operator has always a good prospect of introducing the couching needle with ease, by watching a proper opportunity. The eye has not, at this time, acquired the unsteady rolling motion, which, after a few years, is so common and remarkable in children born blind, or reduced to that state soon after birth. So that this impediment to the easy introduction of the needle does not exist in infants a few months old. The operator also has it in his power, to administer a dose of opium, sufficient to render the steps necessary to expose the eye, almost entirely disregarded by his patient. With respect to the state of the eye itself, but, particularly, that of the cataract, this is more favourable for the operation, than any future period of life. *In infants, the cataract is generally fluid, and merely requires the free rupture of its containing capsule, which is in that case generally opaque. The capsule, however, is tender, and easily removed by the needle, so as to leave an aperture sufficiently large for the admission of light. The milky fluid, which escapes from the capsule, is soon removed by absorption. If, on the other hand, (says Mr. Gibson) the cataract should be soft, it is generally of so pulpy a softness,*

that the free laceration of the anterior part of its capsule, and the consequent admission of the aqueous humour, ensure its speedy dissolution, and disappearance, without the necessity of a second operation. Should the cataract happen to be hard, there will be no more difficulty in depressing it, than in an adult. So uniformly favourable is the state of the cataract to the success of the operation, that I may venture to pronounce, that an operator of common experience and expertness, will seldom fail of success, if he can, in an adult, depress a hard cataract, or rupture the containing capsule, and break down the substance of a soft, or fluid cataract when it occurs.

"Such (continues Mr. Gibson) are the advantages, derived from the age of the patient, and state of the eye, which would induce an operator to use the couching needle a few months after birth. If, however, a surgeon had even difficulties to encounter, which do not occur in adults, surely the invaluable benefit, conferred by enabling an infant to become an intelligent being, like other children, instead of remaining in a state approaching to idiotism, would incline him to run some risk of failure, and to make more than common exertions, especially as there is little chance of injuring the eye, when proper cautions are used. Yet so important a consideration appears to have had little influence upon oculists, and hence, many children have been doomed to years of darkness, happy in the estimation of their parents and friends, if they could distinguish black from white; or discern any perceptible difference between the brightness of the sun, and the glimmering of a tallow candle.

"These advantages, which an operator will possess, when he attempts the removal of a cataract in a child of a few months old, are peculiar to that period. In proportion as the age of the patient advances, until he arrives at the age of discretion, and can estimate, in some measure, the value of sight, by feeling its loss, the difficulties, opposed to the use of the couching needle, increase. His fears of the operation, the unsteadiness of the eye, and his power of retracting it within the orbit, present considerable, but not insuperable obstacles; such, however, as every surgeon would willingly dispense with, if he had it in his power.

"Before an operation, at an early age is recommended, the practitioner ought (as at any other age) to ascertain, that the cataract is not complicated with a defective state of the retina, or with a complete amaurosis. Such cases are by no means uncommon. Some years ago, I recollect to have seen five or six children, the families of two sisters, who were all totally blind, and in an idiotic state, with cataracts accompanied by amaurosis." (*Gibson Op. et loco cit.*)

I find also in this gentleman's paper, some arguments, which have been repeated in Mr. Saunder's work. "Few practitioners, at all conversant with cases with blindness from birth, will deny, that it is highly prob-

able, that the eye may lose a considerable part of its original powers, from the mere circumstance of its having so long remained a passive organ. Hence, probably it happens, that, in some cases of congenital cataract, the only benefit conferred on the patient, by an operation, is that of enabling him to find his way in an awkward manner, and to discriminate the more vivid colours. Such patients have never been able to discern small objects, or to judge in any useful degree, of figure or magnitude; I am well aware, however, says Mr. Gibson, that, in some rare instances, such a defective state of the eye exists from birth.

"Another circumstance, which must have attracted the attention of oculists, is, that in a few years, the eye of a patient born blind, acquires a restless and rolling motion, which is at length so firmly established by habit, that he has little control over it. This motion unfortunately continues, for a considerable time, after sight has been restored to such a person, and is a very material obstacle to the early attainment of a knowledge of the objects of vision. He cannot fix his eye steadily upon one point for a moment, and the inconvenience which arises from this unsteadiness, is, to such a person, occasionally as great a bar to the distinct view of an object, as the unsteady motion of the same object would be to one, whose vision is perfect. This inconvenience any one can appreciate, and, as far as I know, it is completely avoided by restoring sight at an early age.

As a motive for operating on infants, Mr. Gibson also comments on the loss of those years, which ought to be spent in education. (See *Edinb. Med. and Surgical Journal*, Vol. 7, p. 394, 400.)

When once it is decided to operate upon a cataract, the sooner the operation is generally done, the better, because the anxiety of the patient increases, as Beer says, with every day, nay, with every hour. Just before the operation, care must be taken not to let the patient eat a great deal, nor load his stomach with substances difficult of digestion; and, if the stomach and bowels should already be disordered by what they contain, their contents ought to be carefully removed previously to the operation. In the same manner, if the surgeon wish to keep off much inflammation, and the patient should be constipated, this state must be obviated by suitable medicines. And, lastly, when, at the request of the patient himself, the operation is deferred for a few days, the greatest caution must be used not to let him expose himself to any causes, likely to bring on catarrhal or rheumatic complaints. (Beer, B. 2, p. 344.) The following advice delivered by Scarpa, with respect to the preparation of patients for operations on the eye with the needle, is valuable: In ordinary cases, there is not the least occasion for any preparatory treatment previous to the operation; all that prudence requires is, that the patient should abstain from animal food, and fermented liquors, for a few days, be-

fore submitting to it, and should take one dose of a gentle purgative. But, this, like every other general observation, is liable to particular exceptions. Hypochondriacal men, hysterical women, and patients subject to affections of the stomach and nervous system, should take, for two or three weeks before the operation, tonic bitter medicines, particularly the infusion of quassia, either with or without a few drops of the æther vitriolicum to each dose; or, in other cases, 3j of Peruvian bark, with ʒj of valerian, may be administered two or three times a day with particular benefit. It is observed by the most accurate writers upon this subject, that, in such persons, the symptoms consequent to operations upon the eyes, are often much more violent than in common cases; and it therefore seems proper to endeavour, previously, to meliorate their constitutions. When the patient is timid, it is very advisable to give him, half an hour before the time of operating, about fifteen drops of the tinctura opii, with a little wine.

Some patients, besides being afflicted with cataracts, have the edges of the eye-lids swollen and gummy, with relaxation, and chronic redness of the conjunctiva. In this case, before undertaking to couch, it is advisable to apply a blister to the nape of the neck, and to keep it open for two or three weeks, by means of the savin cerate, and to insinuate every morning and evening, between the palpebræ and globe of the eye, a small quantity of the unguentum hydrarg. nitrat. mitius, prepared according to the pharmacopœia of St. Bartholomew's Hospital, increasing its strength gradually. (R. Unguenti hydrargyri nitrati, ʒiv. Adipis Suillæ ʒviij. Olei Olivæ, ʒij.) In obstinate cases, when this ointment does not produce the desired effect, an ointment recommended by Janin, (*Memoires sur l'Oeil*), should be substituted: it consists of ʒss of hog's lard, ʒij of prepared tutty, ʒij of armenian bole, and ʒj of the white calx of quicksilver. At first, care should be taken to use it lowered, with twice or thrice its quantity of lard. In the day time, a collyrium, composed of ʒiv of rosewater, ʒss of the mucilage of quince seeds, and gr. v. of the sulphate of zinc, may also be frequently used with considerable advantage. By such means, the morbid secretion from the Meibomian glands, and membranous lining of the eye-lids, will be checked, and the due action of the vessels, and natural flexibility of the eye-lids, will be restored. (*Saggio di Osservazioni, &c. sulle principali malattie degli occhi*, Venez. 1802.)

There are three different operations practised for the cure of cataracts, viz. one termed *coughing*, or *depression*, of which the method, called *reclination*, is a modification, as will be hereafter explained; another, named *extraction*; and a third denominated *keratonyxis*, which consists in puncturing the cornea with a needle, the point of which is to be conveyed through the pupil, so as to reach the cataract which is to be

gently broken into fragments. As Beer observes, each of these modes has, in particular cases, manifest advantages over the other two; but, no single method will ever be exclusively preferred, and invariably followed, by any man of experience and judgment. In every operation for a cataract, the position of the patient, assistants, and surgeon, is of great importance. In order to enable the assistant who stands behind the patient, to be conveniently near the head of the latter, Beer prefers letting the patient sit on a stool, which has no back. However, as I shall presently notice, some eminent surgeons have urged good reasons in favour of employing a chair, which is completely perpendicular. When the left eye is to be operated upon, the same assistant is to apply his right-hand under the patient's chin, and press the head of the latter against his breast, at the same time that he inclines it and himself more or less forward towards the operator, who sits upon rather a high stool, in front of the patient. In this country, a music-stool is commonly preferred, the height of which can be regulated in a moment, by simply turning the seat round to the right, or left, whereby the screw, with which it is connected, is made to rise, or descend, as may be found most desirable. The same assistant then places his left-hand flat upon the left side of the patient's forehead, with the points of the fore and middle fingers, somewhat under the edge of the upper eye-lid; and, with the fore-finger, he is now to raise the edge of this eye-lid, as much as possible, following that finger immediately with the middle one, so as to fix the eye-lid with greater certainty. The ends of these fingers, however, must be so applied, as not to touch the globe of the eye in the slightest manner, much less make any pressure upon it, yet, so that the upper part of the eye-ball and cornea may be gently resisted by them, when the eye rolls upwards away from the instrument about to be introduced, whereby this position, which is extremely convenient to the operator, may be immediately rectified. The patient should also sit obliquely opposite a clear window, so that a sufficient light may fall obliquely upon the eyes, without any rays being reflected to the cornea, and becoming a hinderance to the operator. Nor should light from any other quarter be ever allowed to fall upon the eyes. The surgeon should sit in front of the patient, whose head ought to be directly opposite the operator's breast, whereby the latter will be enabled to see from above, with the greatest correctness, every thing in the eye during the operation, and will not be under the necessity of raising his arms too considerably. Supposing it to be the left eye, which is to be operated upon, he next effectually draws down the lower eye-lid with the left fore-finger, the end of which must be placed over the edge of the eye-lid, towards the globe of the eye, just like those of the assistant, who supports the upper

eye-lid. The middle finger is then to be applied in a similar way over the caruncula lachrymalis. The operator now takes in his right-hand the requisite instrument for the operation, viz. the needle, or knife, which is to be held, like a pen, between the thumb and the fore and middle fingers. By this particular arrangement of the fingers of the assistant and operator, which, indeed, is partly ineffectual where the fissure of the eye-lids is very narrow, and the eye-ball is diminutive and sunk in the orbit, the restless eye of the timid patient is fixed; for a point of the finger is disposed on every side, to which the eye can possibly turn away from the instrument about to be introduced, and when the cornea is gently touched with the extremity of the finger, the wronged position, which the eye is about to take, is immediately prevented. This method of fixing the eye, says Beer, is not merely indispensable for young operators, but is the only perfectly unobjectionable one, which can be employed on this delicate organ, since all mechanical inventions for this purpose, like the speculum oculi, which keeps the eye steady, by considerable pressure, or other contrivances, like Rumpelt's instrument, which does the same thing by means of a short-pointed instrument attached to a kind of thimble, and with which the sclerotica is pierced and held motionless, are found by experience to be worse than useless. And, as a proof of this fact, Beer adverts to the numerous patients, who come out of the hands of such operators as employ these instruments, with a more or less hurtful loss of the vitreous humour, and other ill consequences: a statement, which nearly agrees with the observations of Wenzel and Ware.

Baron Wenzel considers all instruments, for fixing the eye, quite unnecessary: they render the operation more complicated, more dreadful to the patient, more embarrassing to the operator, and are very liable to irritate and wound the eye. If he could approve of any kind of speculum, he should give the preference to Rumpelt's thimble, at the end of which is a sharp-pointed instrument, like the pique of Parmard. The thimble is placed on the middle finger of the operator, and it has the advantage of not obstructing the use of the fore-finger, but leaves it at liberty to keep down the lower eye-lid.

The pressure, occasioned by all contrivances for fixing the eye, is a serious objection to their employment, as it is apt to cause a sudden protrusion of great part of the vitreous humour. (*Wenzel.*)

The late Mr. Ware coincided with Wenzel, respecting the general objections to specula. At the same time, he remarks, that, in some instances, of children born with cataracts, he had been obliged to fix the eye with a speculum; without the aid of which, he found it totally impracticable to make the incision through the cornea, with any degree of precision, or safety. His speculum is an oval ring, the longest

diameter of which is about twice as long as the diameter of the cornea, and the shortest about half as long again as this tunic. Annexed to the upper rim of the speculum is a rest, or shoulder, to support the upper eye-lid, and by its lower rim, it is fixed to a handle of such a length, and bent in such a way, as may render it convenient to be held. (Ware.)

Nor does Beer entertain a higher opinion of other inventions, made for the purpose of enabling surgeons to operate on both eyes with the right hand; for, says he, the right eye should always be operated upon with the left-hand, and the left with the right, and he who cannot learn to be equally skilful with both his hands, must always remain a bungler. (*Lehre von den Augenkr. B. 2, p. 347—350.*)

Mr. Alexander, whose great skill in operations on the eye is universally acknowledged, employs no assistant for raising the upper eye-lid, or fixing the eye, which objects he accomplishes himself; and, in Germany, this independent mode of proceeding has been particularly commended by Barth. (*Etwas über die Ausziehung des grauen Staare, für den geübten Operateur, 8vo. Wien. 1797.*)

The preceding directions, respecting the position of the assistant, the seats for the patient and surgeon, and the mode of fixing the eye, are chiefly those of Professor Beer. Whether these instructions are in every respect better than the following, which combine the sentiments of some other writers of experience, the impartial reader must judge for himself. The patient should be seated rather low, opposite a window where the light is not vivid, and in such a manner, that the rays may fall laterally upon the eye about to be couched. The other eye, whether in a healthy or diseased state, ought always to be closed, and covered with a handkerchief, or any thing convenient for the purpose; for, so strong is the sympathy between the two organs, that the motions of the one constantly produce a disturbance of the other. The surgeon should sit upon a seat, rather higher than that upon which the patient is placed; and, in order to give his hand a greater degree of steadiness in the various manœuvres of the operation, he will find it useful to place his elbow upon his knee, which must be sufficiently raised for this purpose, by a stool placed under the foot. The chair, on which the patient sits, ought to have a high back, against which his head may be so firmly supported, that he cannot draw it backward during the operation. The back of the chair must not slope backward, as that of a common one, but be quite perpendicular, in order that the patient's head may not be too distant from the surgeon's breast. (*Richter's Anfangsgr. der Wundarzn. p. 207, 3 B.*)

The propriety of supporting the patient's head rather upon the back of the chair, on which he sits, than upon an assistant's breast, as Bischoff has observed, is founded

upon a consideration, that the least motion of the assistant, even that necessarily occasioned by respiration, causes, also, a synchronous motion of the part, supported on his breast, which cannot fail to be disadvantageous, both in the operation of extraction, and of couching. Hence, Callisen and Richter, both recommended the method of supporting the patient's head against the perpendicular back of the chair. But, as this is not at present the common practice, possibly the inconvenience of having the back of the chair between the assistant and the patient, may more than counterbalance the circumstance, in which it seems to be advantageous.

In certain cases, where the muscles of the eye and eye-lids, are incessantly affected with spasm; or, where the eye is peculiarly diminutive, and sunk as it were, in the orbit, the elevator for the upper eye-lid, invented by Pellier, and approved by Scarpa, may possibly prove serviceable: in young subjects, I think it might contribute much to facilitate the operation.

The particular sentiments of Wenzel and Ware, concerning the mode of fixing the eye, will be further explained in the description of the extraction of the cataract.

OF COUCHING, OR DEPRESSION OF THE CATARACT, AND RECLINATION.

The operation of couching was once supposed to consist altogether in removing the opaque lens out of the axis of vision, by means of a needle, constructed for the purpose; but, it is well known to be frequently effectual on another principle, even when the nature and consistence of the cataract do not admit of the depression of the opaque body. In short, experience fully proves that the diseased lens, when broken and disturbed with the needle, and especially when freely exposed to the contact of the aqueous humour by a proper laceration of its capsule, is gradually dissolved and removed by the action of the absorbents.

However, when a surgeon speaks of depression, he always means the operation of pushing the cataract nearly perpendicularly, and to a sufficient depth below the pupil into the vitreous humour, so as to prevent the opaque substance from being an impediment to vision. Writers of the highest reputation and greatest experience differ so widely about the merits of this operation, that, I think it fair to conclude, that, on each side, strong prejudices and exaggerations have been suffered to enter the question. In general, it will be observed, that oculists, and others, who seek for a name in this branch of surgery, decry the operation of depression; and, if it were designed to make the use of the needle an exclusive practice, then I believe the results of modern experience would compel every impartial surgeon to enter a protest against the decision. In this respect, the doctrines of Pott, Callisen, Hey, and Scarpa, are undoubtedly wrong, though their sentiments are blended with many valuable

and important truths. Beer, who is by no means a great advocate for depression, admits its utility in particular cases. It is easily comprehensible, says he, that in this way, a firm and large cataract, either cannot be removed without injuring the retina, and the attachment of the corpus ciliare to the vitreous humour, or not far enough to prevent the opaque body from rising again at the first opportunity. Hence, the former complaints about the frequent return of the cataract, and other ill consequences, unappeasable vomiting, suddenly produced amaurosis, and severe inflammation, &c. But, while Beer acknowledges the frequency of these ill effects of depression, he condemns the universal rejection of it, attempted at the present day, and the unlimited substitution for it of *reclination*, which consists in applying the needle in a certain manner to the anterior surface of the cataract, and depressing the opaque body into the vitreous humour, in such a way, that the front surface of the cataract is now the upper one, its back surface the lower one, its upper edge backwards, and its lower edge forwards; a change, which Beer says, cannot be made without an extensive destruction of the cells of the vitreous humour. Hence, with few exceptions, this author thinks the common mode of depression should be preferred. (*Lehre von den Augenkr. B. 2, p. 352.*) And, in this sentiment, he is joined by Mr. Travers, who remarks, that the real objection to couching is the breaking up of the fine texture of the globe of the eye, by the forcible depression of the lens. "Whether it be depressed edgeways or breadthways, makes no difference in the result; it must still occupy a breach in the cells of the vitreous humour, and must derange and disorder that delicate texture, and those connected with it. A slow insidious inflammation marked by a gradual development of the symptoms of disorganization, viz. congestion of vessels, turbid humours, flaccid tunics, and palsied iris, is too often the consequence. The sight, instead of improving, when the immediate effects of the injury are passed away, remains habitually weak and dim, or declines and fades altogether. The advocates for *reclination* seem to forget, that the principle, which is the same in both operations, is the real ground of objection. As to the position of the lens, I suspect less mischief is done by the old method of depression, as less force is required to break a space for the vertical, than the horizontal lens, provided the depression be carried to no greater extent, than is necessary to clear the inferior border of the pupil." (*Synopsis of the Diseases of the Eye, p. 318.*)

Beer divides both the operations of couching and reclination into three stages: the first is that in which the needle is introduced into the eye; the second that, in which it is passed into the posterior chamber and placed across the anterior surface of the cataract; the third is that, in which the operator accomplishes the act of depression, or reclination.

There are two couching needles, which now seem to be generally preferred; namely, that which was used by the late Mr. Hey; and that recommended by Scarpa.

The length of Mr. Hey's needle is somewhat less than an inch. It would be sufficiently long if it did not exceed seven-eighths of an inch. It is round, except near the point, where it is made flat by grinding two opposite sides. The flat part is ground gradually thinner to the extremity of the needle, which is semi-circular, and ought to be made as sharp as a lancet. The flat part extends in length, about an eighth of an inch, and its sides are parallel. From the part where the needle ceases to be flat, its diameter gradually increases towards the handle. The flat part is one-fortieth of an inch in diameter. The part which is nearest the handle, is one-twentieth of an inch. The handle, which is three inches and a half in length, is made of light wood, stained black. It is octagonal, and has a little ivory inlaid in the two sides, which correspond with the edge of the needle.

Mr. Hey describes the recommendations of this instrument in the following terms:

1. "It is only half the length of the common needle; and this gives the operator a greater command over the motions of its point, in removing the crystalline from its bed, and tearing its capsule. It is also of some consequence, that the operator should know how far the point of his needle has penetrated the globe of the eye, before he has an opportunity of seeing it through the pupil; as it ought to be brought forwards when it has reached the axis of the pupil. Now he may undoubtedly form a better judgment respecting this circumstance, when the length of his needle does not much exceed the diameter of the eye, than when he uses one of the ordinary length, which is nearly two inches. The shortness of the needle is peculiarly useful, when the capsule is so opaque that the point cannot be seen through the pupil.

2. "As this needle becomes gradually thicker towards the handle, it will remain fixed in that part of the sclerotic, to which the operator has pushed it, while he employs its point in depressing and removing the cataract. But the spear-shaped needle, by making a wound larger in diameter, than that part of the instrument, which remains in the sclerotic, becomes unsteady, and is with difficulty prevented from sliding forwards against the ciliary processes, while the operator is giving it those motions which are necessary for depressing the cataract.

"On the same account the common spear-shaped needle may suffer some of the vitreous humour to escape during the operation, whereby the iris and ciliary processes would be somewhat displaced, and rendered flaccid; whereas the needle which I use, making but a small aperture in the sclerotic, and filling up that aperture completely during the operation, no portion of the vitreous humour can flow out so as to render the iris and ciliary processes flaccid.

3. "This needle has no projecting edges; but the spear-shaped needle, having two sharp edges, which grow gradually broader to a certain distance from its point, will be liable to wound the iris, if it be introduced too near the ciliary ligament, with its edges in a horizontal position. I have been informed, that, in an operation performed by one of the most eminent surgeons in the metropolis, now deceased, the iris was divided as far as the pupil. If the operator, in order to avoid this danger, introduces his needle with its edges in a vertical position, he will divide the fibres of the sclerotic transversely, and, by thus enlarging the wound, will increase the unsteadiness of the instrument. Besides, however the needle be introduced, one of its sharp edges must be turned toward the iris in the act of depressing the cataract; and, in the various motions which are often necessary in this operation, the ciliary processes are certainly exposed to more danger than when a needle is used which has no projecting edge.

4. "It has no projecting point. In the use of the spear-shaped needle, the operator's intention is to bring its broadest part over the centre of the crystalline. In attempting to do this, there is great danger of carrying the point beyond the circumference of the crystalline, and catching hold of the ciliary processes, or their investing membrane, the *membrana nigra*. This accident is the more probable, as the point of the needle must unavoidably be directed obliquely forwards, and this motion, if carried too far, brings the point into contact with the ciliary processes, as they surround the capsule of the crystalline.

"A needle, (recommended by Mr. Hey,) will pass through the sclerotic with ease. It will depress a firm cataract readily, and break down the texture of one that is soft. If the operator finds it of use to bring the point of the needle into the anterior chamber of the eye, (which is often the case,) he may do this with the greatest safety, for the edges of the needle will not wound the iris. In short, if the operator, in the use of this needle, does but attend properly to the motion of its point, he will do no avoidable injury to the eye, and this caution becomes the less embarrassing, as the point does not project beyond that part of the needle by which the depression is made, the extreme part of the needle being used for this purpose." (Hey.)

Scarpa employs a very slender needle, possessing a sufficient firmness to enter the eye without hazard of breaking, and having a point, which is slightly curved. The curved extremity of the needle is flat upon its dorsum, or convexity, sharp at its edges, and has a concavity, constructed with two oblique surfaces, forming in the middle a gentle eminence, that is continued along to the very point of the instrument; there is a mark on the side of the handle, which corresponds to the convexity of the point. The surgeons of the Leeds Infirmary have had one advantage in the needle, which they

have used in imitation of Baron Hilmer; I mean, having it made of no greater length, than the purposes of the operation demand. A couching needle is sufficiently long when it does not exceed, at most, an inch in length: this affords the operator a greater command over the motions of the point, and enables him to judge more accurately, how far it has penetrated the globe of the eye, before he has an opportunity of seeing it through the pupil. To the needle, therefore, so much recommended by Scarpa, and so successfully used by him, and Dr. Morigi, principal surgeon of the hospital at Piacenza, and one of the most expert operators of the present day in Italy, it seems proper to unite the improvement of having it made no longer than is necessary. The needle, here described, will penetrate the sclerotic coat as readily as any straight one, of the same diameter, and, by reason of its slenderness, will impair the internal structure of the eye less in its movements, than common couching needles. When cautiously pushed in a transverse direction, till its point has reached the upper part of the opaque lens, it becomes situated with its convexity towards the iris, and its point in an opposite direction; and, upon the least pressure being made by its convex surface, it removes the cataract a little downward, by which a space is afforded at the upper part of the pupil, between the cataract and the ciliary processes, through which the instrument may be safely conveyed in front of the opaque body and its capsule, which it is prudent to lacerate in the operation. In cases of caseous, milky, and membranous cataracts, the soft pulp of the crystalline may be most readily divided, and broken peice-meal by the edges of its curved extremity; and the front layer of the capsule lacerated into numerous membranous flakes, which, by turning the point of the instrument towards the pupil, may be as easily pushed through this aperture into the anterior chamber, where Scarpa finds absorption takes place more quickly, than behind the pupil.

I ought to mention, however, that Beer, and a few other skilful operators, still give the preference to a straight spear-pointed needle; and, if such an instrument be selected, I do not think a better one can be devised, than that described by Scarpa, but made quite straight.

As Mr. Travers has observed, in all cases of operation with the needle, the employment of a solution of the extract of belladonna in an equal part of distilled water, is a point of the first importance. "The space, included between the eyebrow and lash, should be thickly painted with the solution once, or oftener, in the twenty-four hours, and this varnish should be preserved moist for a period of half an hour, in order to admit of its absorption. The frequency of the application must be determined by its effect upon the pupil. The preternatural dilatation should not be permanently maintained; for, if it be, the pupil will in all probability be mis-shapen," when the use of the

belladonna is suspended, and the iris recovers its power. (*Synopsis of the Diseases of the Eye*, p. 322.)

The couching needle (if the curved one be used) is to be held with its convexity forward; its point backward; and its handle parallel to the patient's temple. The surgeon, having directed the patient to turn the eye towards the nose, is to introduce the instrument boldly through the sclerotic coat, at the distance of at least one line and a half from the margin of the cornea, for fear of injuring the ciliary processes. Most authors advise the puncture to be made at about one line, and some even at the minute distance of 1-16th of an inch (*Hey*) from the union of the cornea with the sclerotica; but, as the ciliary processes ought invariably to be avoided, and there is no real cause to dread wounding the aponeurosis of the abductor muscle, as some have conceived, the propriety of puncturing the globe of the eye, at the distance of one line and a half, or two, from the margin of the cornea, as advised by Petit, Platner, Bertrandi, Beer, &c. must be sufficiently manifest.

Nor is it a matter of indifference, at what height the needle is introduced, if it be desirable to avoid, as much as possible, effusion of blood in the operation. Anatomy reveals to us, that the long ciliary artery pursues its course to the iris, along the middle of the external convexity of the eye-ball, between the sclerotic and choroid coats; and hence, in order to avoid this vessel, it is prudent to introduce the instrument a full line below the transverse diameter of the pupil, as Dudell, Guntz, Bertrandi, Beer, Scarpa, &c. have directed. If the couching needle were introduced higher than the track of the long ciliary artery, it would be inconvenient for the depression of the cataract.

The exact place, where the point of the needle should next be guided, is, no doubt, between the cataract and ciliary processes, in front of the opaque lens, and its capsule: but, as I conceive, the attempt to hit this delicate invisible mark, borders upon impossibility, and, with a straight pointed needle, might even endanger the iris, I cannot refrain from expressing my dissent to the common method of passing a couching needle at once in front of the cataract. On the contrary, it seems safer to direct the extremity of the instrument immediately over the opaque lens, and, in the first instance, to depress it a little downward, by means of the convex flat surface of the end of the needle, in order to make room for the safe conveyance of the instrument, between the cataract, and corpus ciliare, in front of the diseased crystalline and its capsule; taking care, in this latter step of the operation, to keep the marked side of the handle forward, by which means the point of the needle will be in an opposite direction to the iris, and will come into contact with the diseased body, and the membrane binding it down in the fossula of

the vitreous humour. When this has been done, and the case is a firm cataract, the instrument will be visible through the pupil; and now we are to push its point transversely, as near as possible the margin of the lens, on the side next the internal angle of the eye, taking strict care to keep it continually turned backward. The operator is then to incline the handle of the instrument towards himself, whereby its point will be directed through the capsule, into the substance of the opaque lens; and, on making a movement of the needle, describing the segment of a circle, at the same instant inclining it downward and backward, he will lacerate the former, and convey it, in the generality of cases, with the latter, deeply into the vitreous humour.

Beer, as I have explained, gives the preference to a spear-pointed straight needle, one flat surface of which, at the period of its first introduction into the eye, is turned upwards; the other, downwards; one edge, directed towards the nasal, the other, towards the temporal canthus; and the point towards the centre of the eyeball. Beer prefers this mode of proceeding, in order to avoid moving the lens too soon out of its natural situation, whereby the subsequent manœuvres of depression or reclinacion, he thinks would be rendered very uncertain and incomplete. He also recommends the surgeon to support his hand in some measure on the patient's cheek by means of the little finger, so as to have it in his power to check the too sudden and deep entrance of the instrument into the eye, liable to happen when the broadest part of the spear-point has passed through the sclerótica. (*Lehre*, &c. B. 2, p. 354.)

It happened, unfortunately for the credit of the operation of depression, that Petit admonished surgeons to beware of wounding the anterior layer of the crystalline capsule: he had an idea, that, when this caution was observed, the vitreous humour would afterward fill up the space, previously occupied by the lens, and that thus the refracting powers of the eye might become as strong as in the natural state, and the necessity for using spectacles be considerably obviated. But, we are now apprized, that leaving this very membrane, from which Petit anticipated such great utility, even were it practicable to leave it constantly uninjured in its natural situation, would be one of the worst inculcations that could possibly be established; for, in many cases, where extraction proves fruitless, in some, where depression fails, the want of success is owing to a subsequent opacity of the crystalline capsule; in short, blindness is reproduced by the secondary membranous cataract. It seems more than probable, that, in some of the instances, where the opaque lens has been said to have risen again, nothing more has happened, than the disease in question. Therefore, notwithstanding the whole capsule in the majority of cases may be depressed with the lens out of the axis of vision, as it is not a constant occur-

rence, I cannot too strongly enforce the propriety of extirpating, as it were, every source and seat of the cataract in the same operation, and, in imitation of the celebrated Scarpa, who is entitled to the honour of having first pointed out the great importance, of this practice, I shall presume to recommend, as a general rule in couching, always to lacerate the front layer of the capsule, whether in an opaque or transparent state.

The capsule of the crystalline lens may retain its usual transparency, while the lens itself is in an opaque state. In this case, an inexperienced operator might, from the blackness of the pupil, suppose, not only that he had removed the lens but also the capsule from the axis of sight; and, having depressed the cataract, he might unintentionally leave this membrane entire in its natural situation. Therefore, if there should be any reason for suspecting, that the anterior layer of the capsule has escaped laceration; if, in other words, the resistance made to moving the convexity of the instrument forward, towards the pupil, should give rise to such a suspicion; for the sake of removing all doubt, it is proper to communicate to the needle a gentle rotatory motion, by which its point will be turned forward, and disengaged, through the transparent capsule, opposite the pupil: then, by repeating a few movements downward and backward, it will be so freely rent with the needle, as to occasion no future trouble.

If a straight, slender, spear-pointed needle be used, like that of Beer, and the second stage of the operation be completed by the introduction of the extremity of the instrument into the posterior chamber, then, according to the directions given by the same writer, when depression is indicated, the needle is to be immediately carried to the uppermost part of the cataract, with its point directed somewhat obliquely downwards; and with that surface, which in the first instance, was applied to the front of the lens, now placed upon its superior edge; then the opaque body is to be pushed rather obliquely, downwards and outwards, so far below the pupil, that it can no longer be distinguished. After this has been done, the needle is to be gently raised, in order to see whether the cataract will continue depressed, and if it be found to do so, the needle is to be withdrawn in the same direction, in which it was introduced.

On the other hand, says Beer, when re-clination is to be practised, the needle after being applied to the front surface of the cataract, is not to be moved further out of the position of the second stage of the operation, but its handle is merely to be raised diagonally forwards, whereby the cataract will be pressed downwards and outwards to the bottom of the vitreous humour, and turned in the manner already specified. Beer has delivered what appears to me one valuable piece of advice for operators on the eye with the needle: whether depres-

sion, or re-clination, is to be done, says he, a surgeon can only use this instrument without injurious consequences on the principle of a lever; and every attempt to press with the whole length of the instrument is not only ineffectual, with respect to the progress of the operation, but so hurtful to the eye, that bad effects must follow, as may be readily conceived, when it is recollected how violently the ciliary nerves must be stretched.

As for the modifications of the manœuvres, rendered necessary by the varieties of cataracts, they are (says Beer) so unimportant in all cases of depression, that a young operator will easily understand them himself. But, things are far otherwise in the practice of re-clination; for, when the case is a completely formed *capsular-lenticular cataract*, and the opaque capsule is so thin, as to be torn during the turning of the lens, the latter body will indeed be placed in the intended position at the bottom of the eye, but the capsule itself, which has merely been lacerated, must form a secondary cataract, unless the surgeon, with a sharp double-edged needle, immediately divide it in every direction, and remove it as far as possible from the pupil. When, during re-clination, a *softish lens*, or one which is *pulpy* to its very nucleus, breaks into several pieces, it is necessary, in order not to have afterwards a considerable secondary lenticular cataract, to put the larger fragments separately in a state of re-clination, while the smaller ones may either be depressed, or (if the pupil be not too much contracted) they may be pushed into the anterior chamber, where they will soon be absorbed.

When the cataract is partially adherent to the uvea, Beer recommends an endeavour to be first made, with the edge of the needle, (which is to be introduced flat between the cataract and the uvea, above or below the adhesion) to separate the adherent parts before the attempt at re-clination is made. Should it be a cataract, which always rises again as soon as the needle is taken from it, though the instrument has not pierced it at all, the case is termed the *elastic cataract*, in which the lens is not only firmly adherent to its own capsule, but this also to the membrana hyaloidea. Here Beer thinks, that the best plan is first to carry the needle to the uppermost point of the posterior surface of the lens, and by means of perpendicular movements of the cutting part of the instrument, to endeavour completely to loosen this preternatural adhesion of the cataract to the vitreous humour, when re-clination may be tried again, and will perhaps succeed. But, says Beer, when the continual rising of the cataract is caused by the operator's running the needle into it, the instrument must either be withdrawn far enough out of the eye to let it be again properly brought into the posterior chamber, when re-clination may be effectually repeated; or, if the cataract be firmly fixed on the needle at the bottom of the eye, the instrument should not be raised again, but previously to being withdrawn, it should be rotated a couple of

times on its axis, whereby the pierced lens will be more easily disengaged from the needle, and at last continue depressed. (*Lehre von den Augenkr. B. 2, p. 356—358.*)

In addition to Beer's directions for couching and reclinacion, the following observations seem to me to merit attention.

When the case is a *fluid* or *milky* cataract, the operator frequently finds, that, on passing the point of the couching needle through the anterior layer of the capsule, its white milky contents instantly flow out, and, spreading like a cloud over the two chambers of the aqueous humour, completely conceal the pupil, the iris, and the instrument, from his view; who, however, ought never to be discouraged at this event. Although it seems to me most prudent, to postpone the completion of operations with the needle, in the example of blood concealing the pupil, in the first step of couching, and not to renew any attempt before the aqueous humour has recovered its transparency; I am inclined to adopt this sentiment, chiefly because the species of cataract is, in this circumstance, generally unknown to the operator, consequently he must be absolutely incapable of employing that method of couching, which the peculiarities of the case may demand. Speaking of this case, however, Beer says, "the surgeon must hasten the completion of extraction, or reclinacion, though possibly the operation may not always admit of being continued, or, if gone on with, it must be done, as it were blindfold." (*Lehre, &c. B. 2, p. 361.*) When a milky fluid blends itself with the aqueous humour, and prevents the surgeon from seeing the iris and pupil: this event itself is a source of information to him, inasmuch as it gives him a perfect insight into the nature of the cataract, which he is treating; and instructs him what method of operating it is his duty to adopt. The surgeon, guided by his anatomical knowledge of the eye, should make the curved point of the needle describe the segment of a circle, from the inner, toward the outer canthus, and in a direction backward, as if he had to depress a firm cataract. (*Scarpa.*) Thus he will succeed in lacerating, as much as is necessary, the anterior layer of the capsule, upon which, in a great measure, the perfect success of the operation depends; and, not only in the milky, but almost every other species of cataract.

In regard to the extravasation of the milky fluid in the chambers of the aqueous humour, numerous observations, from the most creditable authorities, prove, that it spontaneously disappears very soon after the operation, and leaves the pupil of its accustomed transparency. "In twelve cases of a dissolved lens, on which I have operated," says Latta, "the dissolution was so complete, that, on entering the needle into the capsule of the lens, the whole was mixed with the aqueous humour, and all that could be done, was to destroy the capsule as completely as possible, that all the milky matter might be evacuated. In ten of these

cases, vision was almost completely restored in four weeks from the operation. Mr. Pott, in treating of this circumstance, viz. the effusion of the fluid contents of the capsule into the aqueous humour, observes, that so far from being an unlucky one, and preventive of success, it proves, on the contrary, productive of all the benefit which can be derived from the most successful depression or extraction, as he has often and often seen.

When the cataract is of a *soft*, or *caseous* description, the particles of which it is composed will frequently elude all efforts made with the needle to depress them, and will continue behind the pupil in the axis of vision. This has been adduced as one instance that baffles the efficacy of couching, and may really seem to the inexperienced, an unfortunate circumstance. It often happens in the operation of extraction, that fragments of opaque matter are unavoidably overlooked and left behind; yet Richter confesses, that such matter is frequently removed by the absorbents. Supposing a caseous cataract were not sufficiently broken, and disturbed in the first operation, and that, consequently, the absorbents did not completely remove it, such a state might possibly require a reapplication of the instrument; but this does not generally occur, and is the worst that can happen. It is quite impossible to determine *a priori*, what effect will result from the most trivial disturbance of a cataract; its entire absorption may, in some instances, follow, while in others, a repetition of the operation becomes necessary for the restoration of sight. Even where the whole firm lens has reascended behind the pupil, as Latta and Hey confirm, the absorbents have superseded the necessity for couching again. The disappearance of the opaque particles of cataracts was, in all times, and in all ages, a fact of such conspicuousness, that, as appears from the authority of Barbette and others, it was recorded, even previous to the discovery of the system of lymphatic vessels in the body. Indeed the modern observations of Scarpa and others, so strongly corroborate the account which I have given of the vigorous action of the absorbents, in the two chambers of the aqueous humour; and particularly, in the anterior one, that, from the moment the case is discovered to be a soft, or caseous cataract, it seems quite unnecessary to make any further attempt to depress it into the vitreous humour. Mr. Pott sometimes, in this circumstance, made no attempt of this kind, but contented himself with a free laceration of the capsule, and, after turning the needle round and round, between his finger and thumb, within the body of the crystalline, left all the parts in their natural situation, where he hardly ever knew them fail of dissolving so entirely, as not to leave the smallest vestige of a cataract. This eminent surgeon even practised occasionally what Beer sanctions, and Scarpa so strongly recommends at this day; for he sometimes pushed the firm part of such

cataracts through the pupil into the anterior chamber, where it always disappeared, without producing the least inconvenience ; we must, at the same time add, that he thought this method wrong, not on account of its inefficacy, but an apprehension that it would be apt to produce an irregularity of the pupil, one of the worst inconveniencies attending the operation of extraction. But the deformity of the pupil, after extraction, seems to proceed either from an actual laceration of the iris, or a forcible distention of the pupil, by the passage of large cataracts through it, a kind of cause that would not be present in pushing the broken portions of a caseous lens into the anterior chamber. Hence, it does not seem warrantable to reject this very efficacious plan of treatment. It is well deserving of notice, that Mr. Hey, who has several times seen the whole opaque nucleus and very frequently small opaque portions fall into the anterior chamber, makes this remark : " Indeed, if the cataract could, in all cases, be brought into the anterior chamber of the eye, without injury to the iris, it would be the best method of performing the operation." What the same author also observes in the subsequent part of his work, is strikingly corroborative of the efficacy of Scarpa's practice. The practice of the Italian professor consists in lacerating the anterior portion of the crystalline capsule, to the extent of the diameter of the pupil in a moderately dilated state : in breaking the pappy substance of the diseased lens piecemeal ; and in pushing the fragments through the pupil into the anterior chamber, where they are gradually absorbed.

One great advantage of couching, insisted upon by Scarpa, depends upon its generally removing the capsule, at the same time with the lens, from the passage of the rays of light to the retina. Sometimes, however, this desirable event, by which the patient is extricated from the danger of a *secondary membranous cataract*, does not take place even in the operation of depression ; and, when the lens included in its capsule is extracted from the eye, by the other method, it may always be considered as rather an uncommon circumstance. What most frequently constitutes the secondary membranous cataract, is the anterior half of the capsule, which not having been removed, or sufficiently broken, in a previous operation, continues more or less entire in its natural situation, afterwards becomes opaque, and thus impedes the free transmission of the rays of light to the seat of vision. Sometimes the secondary membranous cataract presents itself beyond the pupil, in the form of membranous flakes, apparently floating in the aqueous humour, and shutting up the pupil : at other times it appears in the form of triangular membranes, with their bases affixed to the *Membrana Hyaloidea*, and their points directed towards the centre of the pupil. When there is only a minute membranous flake suspended in the posterior chamber, Scarpa thinks it by no means necessary for the patient to submit to another

operation ; vision is tolerably perfect, and the small particle of opaque matter will, in time, spontaneously disappear. But when the secondary membranous cataract consists of a collection of opaque fragments of the capsule, accumulated so as either in a great degree or entirely to close the pupil ; or when the disease consists of the whole anterior half of the opaque capsule, neglected in a prior operation, and continuing adherent in its natural situation, it is indispensable to operate again ; for, although in the first case, there may be good reason to hope, that the collection of membranous fragments might, in time, disappear, yet it would be unjustifiable to detain the patient for weeks and months in a state of anxiety and blindness, when a safe and simple operation would restore him, in a very short space of time, to the enjoyment of this most useful of the senses. In the second case, says Scarpa, it is absolutely indispensable : for while the capsule remains adherent to its natural connexions, the opacity seldom disappears, and may even expand itself over a larger portion of the pupil. He advises the operation to be performed as follows : when the aperture in the iris is obstructed by a collection of membranous flakes, detached from the *membrana hyaloidea*, the curved needle should be introduced, with the usual precaution of keeping its convexity forward, its point backward, until arrived behind the mass of opaque matter ; the surgeon is then to turn the point of the needle towards the pupil, and is to push through this opening, regularly one after another, all the opaque particles into the anterior chamber, where, as we have before noticed, absorption seems to be carried on more vigorously than behind the pupil. All endeavours to depress them into the vitreous humour, Scarpa has found it to be in vain ; for scarcely is the couching needle withdrawn when they all reappear at the pupil, as if, (to use his own phrase) carried thither by a current : but when forced into the anterior chamber besides, being incapable of blocking up the pupil, they lie without inconvenience, at the bottom of that cavity, and in a few weeks are entirely absorbed.

When the *secondary membranous cataract* consists of the whole anterior layer of the crystalline capsule, or of several portions of it connected with the *membrana hyaloidea*, Scarpa, after cautiously turning the point of the needle towards the pupil, pierces the opaque capsule : or, if there be any interspace, he passes the point of the instrument through it ; then, having turned it again backward, he conveys it, as near as possible, to the attachment of the membranous cataract, and after piercing the capsule, or each portion of it successively, and sometimes carefully rolling the handle of the instrument between his finger and thumb, so as to twist the capsule round its extremity, he thus breaks the cataract, as far as it is practicable, at every point of its circumference. The portions of membrane, by this means separated from their adhesions, are next cautiously pushed, with the point of the

couching needle turned forward, through the pupil, into the anterior chamber. In these manœuvres the operator must use the utmost caution not to injure the iris, and ciliary processes, for upon this circumstance depends the avoidance of bad symptoms after the operation, notwithstanding its duration may be long, and the necessary movements of the needle frequently repeated. If a part of the membranous cataract be found adherent to the iris, (a complication, that will be indicated when, upon moving it backward, or downward with the needle, the pupil alters its shape, and from being circular becomes of an oval, or irregular figure,) even more caution is required than in the foregoing case, so as to make repeated, but delicate movements of the needle, to separate the membranous opacity, without injuring the iris. Beer's mode of proceeding in such a case, I have already described.

Scarpa does not deem it necessary to vary the plan of operating above explained, if occasionally the cataract be formed of the posterior layer of the capsule. And according to this author, the same plan also succeeds in those rare instances where the substance itself of the crystalline wastes, and is almost completely absorbed, leaving the capsule opaque, and including, at most, only a small nucleus, not larger than a pin's head. Scarpa terms it the *Primary Membranous Cataract*, and describes it as being met with in children, or young people under the age of twenty; as being characterized by a certain transparency, and similitude to a cobweb; by a whitish opaque point, either at its centre or circumference; and, by a streaked and reticulated appearance: he adds, that whosoever attempts to depress such a cataract is baffled, as it reappears behind the pupil, soon after the operation: he recommends breaking it freely with the curved extremity of the couching needle, and pushing its fragments into the anterior chamber, where they are gradually absorbed in the course of about three weeks.

No other topical application is generally requisite, after the operation, but a small compress of fine linen; and the patient ought to be kept in a quiet, moderately darkened room. On the following morning, a dose of some mild purgative salt, such as the sulphate of soda, or magnesia, may usually be administered, with advantage. I shall not enlarge upon the method of treatment, when the inflammation, subsequent to couching, exceeds the ordinary bounds; in hypochondriacal, hysterical, and irritable constitutions, this is more frequently met with, and I have already touched upon the propriety of some preparatory measures before operating upon these unfavourable subjects.

Beer remarks, that, although after extraction, very cautious trials of the sight are indispensable, they are by no means proper after the depression or reclinacion of a cataract; for, the action of the muscles of

the eye in the inspection of objects at various distances, is very liable to make the opaque body rise again. Hence, as soon as the pupil is clear, Beer recommends covering both eyes (even when one only has been operated upon) with a plaster, and simple linen compress, which last is to be fastened on the forehead with a common bandage. The same experienced operator also enjoins perfect quietude of the body and head for some days. The patient, he says, may either lie in bed, or sit in an arm-chair, as may be most agreeable, care being taken to avoid all sudden motions. The most proper food for the patient is such as is easily digested, not too nutritious, and does not require much mastication. Every thing must be avoided which has a tendency to excite inflammation in the eye. On the third or fourth day the eye should be opened, and afterwards be merely protected by a green silk eye screen, which should also be gradually dispensed with. The patient should be careful to do whatever is agreeable to the eye which has been operated upon, and as carefully avoid every thing which irritates it, or causes a disagreeable sensation in it, a difficulty of opening the eyelids, or keeping them open, a discharge of tears, or a redness of the white of the eye, &c.

Of the thrombus under the conjunctiva, sometimes caused by the prick of the needle, and of the readily bleeding granulations which occasionally shoot up at the puncture, I need not here particularly speak.—For relieving the obstinate vomiting, sometimes excited by injury of the ciliary nerves, or that of the retina, Beer recommends castor, musk, and opium, except when the eye is in a state of inflammation, in which circumstance, the antiphlogistic treatment is preferable. Such vomiting, Beer joins other writers in believing, is often produced by a firm lens being depressed too far, so as to injure the retina; a case, however, which is usually combined with a suddenly produced, complete, or incomplete amaurosis. Here, unless the position of the lens can be changed by a sudden movement of the head, the above class of medicines will be of no use. This kind of amaurosis may also take place without any vomiting, and, as Beer has had opportunities of remarking, it will not always subside, even though the cataract be made to rise again. The same amaurotic affection may also result from the surgeon hurting the retina by pushing the needle too deeply against this membrane. According to Beer, the ophthalmia, liable to happen in these cases, as well as after extraction and kxatonyxis, is always most severe in the iris and neighbouring textures. (*Von den Augenkr. B. 2, p. 361—63.*)

I cannot help remarking how judicious it is never to attempt too much at one time in any mode of couching. It happens in this, as in most other branches of operative surgery, that celerity is too often mistaken for skill; the operator should not only be

slow and deliberate in achieving his purpose; he should be taught to consider that a repetition of couching may, like the puncture of a vein, be safely and advantageously put in practice again and again; and with far greater security, than if, for the sake of appearing expeditious, or avoiding the temporary semblance of failure, a bolder use of the couching needle should be made, than the delicate structure of the eye warrants. We read, in Mr. Hey's *Practical Observations on Surgery*, that he couched one eye seven times, before perfect success was obtained; had he been less patient, and endeavoured to effect by one or two rough applications of the instrument, what he achieved by seven efforts of a gentler description, it is highly probable, that the structure of the eye would have been so impaired, as well as the consequent ophthalmia so violent, as to have utterly prevented the restoration of sight.

All the various methods of couching having now been described, I subjoin the sentiments of Beer, respecting the circumstances by which the choice of depression or reclinatioin ought to be regulated. According to this author, when the cataract is very firm, or moderately so, with a scabrous surface, or the case is what has been already described under the name of *encysted cataract*, or when the cataract consists of any tough membrane, both depression and reclinatioin can only be a palliative remedy, for, says he, none of these cataracts after the operation can be dissolved and absorbed, but must remain in the eye, as a foreign unorganized body, ready at every opportunity to rise again, and partially or completely blind the patient anew. Beer assures us, that he has carefully examined the eyes of persons after death, on whom depression or reclinatioin had been practised, in some instances, twenty or more years previously; but, in almost all the examples, the lens was found firm and undissolved, or at most only diminished, with, or without its capsule. Membranous cataracts were very trivially lessened; though they had quite lost their tough consistence, and were changed into a firmish white mass. In a living person, Beer says he saw an instance, in which a cataract rose again after it had been depressed by Hilmer thirty years previously: it was small, angular, and, when the pupil was dilated, it floated from one chamber of the eye into the other. When extracted, which was done with complete success, it was found to be almost ossified. In 1805, Beer extracted from a woman, forty years of age, a very large, hard, yellowish, white lenticular-cataract, which had been in the anterior chamber twenty-six years. The lens had been thus displaced by a blow received on the eye from the branch of a tree. Nor has Beer ever yet seen a case, in which a cataract of a semi-firm consistence was dissolved and absorbed. (*Von den Augenkr. B. 2, p. 363.*) Had Beer confined his statements to what happens to certain cataracts, on which depression, or reclinatioin, strictly

so called, had been practised, I should have been disposed to accede to the general assertion, respecting the great length of time, which a firm or tough capsular cataract remains in the vitreous humour undissolved and unabsorbed. But, if he meant that the same thing is generally the case with cataracts broken piecemeal, and placed in the aqueous humour, we know, that such a representation is contradicted by the experience of an infinite number of the highest authorities in surgery. Nay, notwithstanding the case adduced of a bony lens having remained in the aqueous humour twenty-six years, I am disposed to think, that Beer himself does not intend to question the absorption of the fragments of cataracts in the aqueous humour, particularly as at p. 357, B. 2, he sanctions pushing the fragments of semi-firm cataracts through the pupil into the anterior chamber, where, he confesses, that *they are soon absorbed*.

Beer thinks that, in general, depression and reclinatioin are indicated only in cases, in which extraction is absolutely impracticable, or attended with too great difficulty, as will be better understood when this operation is considered. As examples of this kind, Beer specifies an extensive adhesion of the iris to the cornea; a very flat cornea, and, of course, so small an anterior chamber, that an incision of proper size in the cornea cannot be made; a broad arcus senilis; an habitually contracted pupil (incapable of being artificially dilated); an eye much sunk in the orbit, with a small fissure between the eyelids; eyes affected with incessant convulsive motions; a partial adhesion of the cataract to the uvea; unappeasable timidity in the patient; and an impossibility of managing him during and after the operation, in consequence of his childhood or stupidity.

With regard to the question, whether depression or reclinatioin should be preferred, Beer is of opinion, that the first method is indicated only when the dimensions of the cataract are small, and consequently, when there is room enough for it to be placed below the pupil, without the ciliary processes being torn from the annulus ciliaris. Such cases are the *dry-husked, capsulo-lenticular cataract*, (the *primary membranous cataract*, of Scarpa), when perfectly free from adhesions to the uvea; the true *lenticular secondary cataract*, produced by the small but firm fragments of the lens having been left, or risen again; and the genuine *secondary membranous, or capsular cataract*. On the other hand, reclinatioin is to be preferred when, together with the above objections to extraction, the surgeon has to deal with a fully formed, very *hard lenticular, or capsulo-lenticular cataract*; or with a case of the latter kind, complicated with partial adhesions to the uvea; or when the case is a *secondary capsular cataract*, similarly circumstanced; a *secondary cataract of lymph*; a *gypsum-cataract*; or there is reason to apprehend a considerable tendency in the blood-vessels of the interior of the eye to

become varicose. (*Lehre von den Augenkr. B. 2, p. 365.*)

The manner of operating with the needle upon the congenital cataracts of children, will be hereafter explained.

EXTRACTION OF THE CATARACT.

As soon as it was fully proved that the true cataract was an opacity of the crystalline lens; that the loss of sight would not be occasioned by the removal of this body; that the cornea might be divided without danger; and that when the aqueous humour had been discharged, it would be quickly regenerated; the mode of cure, by extracting the cataract out of the eye, naturally presented itself. (*Wenzel*.)

Freytag first made an attempt to extract the cataract, about the close of the 17th century. After him, Lotterius of Turin performed this operation, a good description of which was first given by Daviel; and the ingenuity and industry of Wenzel afterwards brought this mode of operating considerably nearer to perfection. (*Brambilla, Instrumentarium Chir. Austriacum, 1782, p. 71.*)

With the valuable instructions which Ware and Beer have still more recently furnished, the extraction of the cataract may now be regarded as brought to the highest state of improvement. According to Beer, the extraction of the cataract usually admits of division into three stages, the first of which, as in depression and reclinatation, is the most important, because, unless it be performed exactly as it ought to be, the operation will be very liable to fail, and it is exceedingly difficult to make amends for any fault committed in this early part of the proceedings. The first stage consists in making an effectual opening in the cornea with a suitable knife. The second, in dividing the anterior layer of the capsule, which, says Beer, should not be merely punctured, or torn with a bluntish instrument, but cut with a sharp two-edged lance-pointed needle, and, as much as possible, annihilated. In the third stage, the expulsion of the cataract from the eye is effected either by the well-regulated action of the eye-ball itself, or by the assistance of art. But, as Beer remarks, they who have learned the manner of effectually and skilfully cutting the cornea, will frequently have the pleasure to find the two last stages beneficially converted into one, and the operation in general soon and expeditiously completed. (*Von den Augenkr. B. 2, p. 366.*)

The knives, used by Richter, Wenzel, Ware, and Beer, are all of them more or less different; but, they agree in the common quality of completely filling up the wound, as it is extended, so that none of the vitreous humour can escape before the division of the cornea is finished.

Wenzel's knife resembles the common lancet employed in bleeding, excepting that its blade is a little longer, and not quite so broad. Its edges are straight, and the blade

is an inch and a half (eighteen lines) long, and a quarter of an inch (three lines) broad, in the widest part of it, which is at the base. From this part it gradually becomes narrower towards the point; so that this breadth of a quarter of an inch extends only to the space of about one-third of an inch from the base; and, for the space of half an inch from the point, it is no more than one-eighth of an inch broad.

The knife, employed by the late Mr. Ware, is, in regard to its dimensions, not unlike the instrument employed by Wenzel. The principal difference is, that Mr. Ware's knife is less spear-pointed; in consequence of which, when this latter instrument has pierced through the cornea, its lower, or cutting edge will sooner pass below the inferior margin of the pupil, than the knife used by Wenzel. On this account, Mr. Ware believed that the iris would be less likely to be entangled under the knife, which he recommended, than under Wenzel's, when the instrument begins to cut its way downwards, and the aqueous humour is discharged. Mr. Ware particularly advises great care to be taken to let the knife increase gradually in thickness from the point to the handle; by which means, if it be conducted steadily through the cornea, it will be next to an impossibility, that any part of the aqueous humour can escape, before the section is begun downwards; and, consequently, during this time, the cornea will preserve its true convexity.— But, if the blade should not increase in thickness from the point; or if it be incurvated much in its back, or edge, the aqueous humour will unavoidably escape, before the puncture is completed; and the iris, being brought under the edge of the knife, will be in great danger of being wounded by it. But, a better knife than any other which has yet been proposed, is that employed by Beer, a representation of which I have given in Vol. 1, of the *First Lines of Surgery*, plate 7, fig. 3. The sentiments of Richter, Scarpa, Beer, and others, about the position of the patient in the operation, and the mode of fixing the eye, have been already noticed in a foregoing section.

Baron Wenzel determined to run no risk of bad consequences from undue pressure on the eye, made no endeavour to fix this organ at all at the period of cutting the cornea.

The late Mr. Ware did not approve of this plan of leaving the eye unfixed. The danger likely to arise from undue pressure, he observes, can only take place, after the instrument has made an opening into the eye: but the pressure which Mr. Ware advises, in order to fix the eye, is to be removed the instant the knife is carried through the cornea, and before any attempt is made to divide this tunic downwards. To understand this subject better, however, the reader should know, that Mr. Ware divided the incision of the cornea into two distinct processes; the first of which may be called

punctuation, and the second section. So long, says Mr. Ware, as the knife fills up the aperture in which it is inserted, that is, until it has passed through both sides of the cornea, and its extremity has advanced some way beyond this tunic, the aqueous humour cannot be discharged, and pressure may be continued with safety. The punctuation of the cornea being completed, the purpose of pressure is fully answered; and, if such pressure be continued, when the section of the cornea begins, instead of being useful, it will be hurtful. To avoid all bad effects, Mr. Ware recommends the cornea to be cut in the following way.

The operator is to place the fore and middle finger of the left hand, upon the tunica conjunctiva, just below, and a little on the inside of the cornea. At the same time, the assistant, who supports the head, is to apply one, or, if the eye projects sufficiently, two of his fingers, upon the conjunctiva, a little on the inside and above the cornea. The fingers of the operator and assistant, thus opposed to each other, will fix the eye, and prevent the lids from closing. The point of the knife is to enter the outside of the cornea, a little above its transverse diameter, and just before its connexion with the sclerotica. Thus introduced, it is to be pushed on slowly, but steadily, without the least intermission, and in a straight direction, with its blade parallel to the iris, so as to pierce the cornea towards the inner angle of the eye, on the side opposite to that which it first entered, and till about one-third part of it is seen to emerge beyond the inner margin of the cornea. When the knife has reached so far, the punctuation is completed. The broad part of the blade is now between the cornea and the iris, and its cutting edge below the pupil, which of course is out of all danger of being wounded. As every degree of pressure must now be taken off the eyeball, the fingers, both of the operator and his assistant, are instantly to be removed from this part, and shifted to the eyelids. These are to be kept asunder by gently pressing them against the edges of the orbit; and the eye is to be left entirely to the guidance of the knife, by which, says Mr. Ware, it may be raised, depressed, or drawn to either side, as may be found necessary. The aqueous humour being now partly, if not entirely evacuated, and the cornea of course rendered flaccid, the edge of the blade is to be pressed slowly downward, till it has cut its way out, and separated a little more than half the cornea from the sclerotica, following the semicircular direction, marked out by the attachment of the one to the other. (Ware.)

As soon as the point of the knife had arrived opposite the pupil, Wenzel used to incline it gently backward, and thus puncture the capsule of the crystalline. But, Mr. Ware very properly objects to this method of opening the capsule with the instrument used for cutting the cornea, and at the same time. The plan may exhibit dexterity; but is of no use, and is often at-

tended with considerable danger of wounding the iris.

In the eyes of some persons, the iris is convex, and it is almost impossible to complete the section of the cornea, without entangling the iris under the edge of the knife, unless a particular artifice be adopted. Wenzel, in this circumstance, recommends gently rubbing the cornea downward with the finger; one of the most important directions, according to Mr. Ware, in the Baron's whole book.

Wenzel imputed several advantages to the oblique manner in which he used to divide the cornea. The best modern oculists, however, do not imitate this method.

If the edge of the knife should incline too much forward, and its direction be not altered, the incision in the cornea will be too small, and terminate almost opposite the pupil. In this case, there will be great difficulty in extracting the cataract, and the cicatrix afterwards will often obstruct sight. If, on the contrary, the edge of the instrument be inclined too much backward, and its direction be not changed, the incision will approach too near the part where the iris and sclerotica unite, and, there will be great danger of wounding them. These accidents may be prevented by gently rolling the instrument between the fingers, until the blade takes the proper direction.—(Wenzel.)

Mr. Ware has seen operators, through a fear of wounding the iris, introduce and bring out the instrument at a considerable distance before the union of the cornea and sclerotica; in consequence of which, the incision from one side of the cornea to the other has been made too small to allow the easy extraction of the cataract, although from above downward, it was fully large enough for this purpose. Mr. Ware has also sometimes observed, that though the punctuation of the cornea from side to side has been properly conducted, and its section afterwards, to all appearance, effectually completed, yet, on account of the frictions, employed to disengage the iris from the edge of the instrument, the knife, in cutting downward, has been carried between the layers of the cornea, and, consequently, though the incision has appeared externally, to be of its proper size; internally, it has been much too small for allowing the cataract to be easily extracted. In this case, the incision must be enlarged, by means of a pair of curved blunt-pointed scissors, which should be introduced at the part where the knife first entered the cornea. (Ware.)

Beer subdivides the first stage of this operation into four, each of which, he says, claims the utmost attention, if it be wished to make the incision in the cornea in every respect proper: the first is the introduction of the knife through the cornea into the anterior chamber; the second is directing the knife towards the place where its point is to be brought out again; the third is bringing out the point, and guiding the

knife in continuing the incision in the cornea; and the fourth is the finishing of that incision. As Beer states, a completely well-made incision in the cornea, must, in the first place, be of sufficient size to let the cataract escape from the eye without the slightest impediment; and it will be large enough, if care be taken to open one half of the cornea near its edge. Secondly, it must be of a proper shape, its margin not being triangular, nor notched, but evenly rounded. In general, says Beer, no greater disadvantage can happen than that of having too small an incision in the cornea; for, even when the cataract is pressed out of such an opening, portions of it are always left behind, which afterwards cannot be extracted without trouble; and though the sight may be at the moment restored, it will be fortunate if the eye be not afterwards spoiled by the effects of inflammation. When the incision is triangular, or notched, its edges cannot be put smoothly together so as to be healed by the first intention, which, however, is highly necessary, and the consequence is a white ugly scar, which is slowly produced with inflammation, and forms a greater or lesser permanent impediment to vision downwards, though the patient be capable of seeing the smallest objects, which are straight before him.

According to Beer, when the knife is to be introduced, its point should enter the cornea, about one-eighth of a line from its edge, and one-fourth of a line above its transverse diameter, directed obliquely towards the iris, with its edge turned downwards, by which means, the point will pass immediately into the anterior chamber. As soon as it has arrived there, which is indicated partly by the bright extremity of the knife being seen within the space in question, and partly by the *tactus eruditus*, such a direction is to be given to the instrument, that its point may project from the place of its entrance nearly in a direct line towards the intended place of its exit out of the cornea, but a little higher; while the posterior surface of the blade is to be conveyed across the anterior chamber exactly parallel to the iris. The knife is to be cautiously pushed on, neither too quickly nor too slowly, with its point continually directed somewhat upwards above the part, where it is to pass out again, until the point arrives near the inner edge of the cornea; but, in the transverse passage of the knife, its edge should not be suffered either to go nearer to, or further from, the iris, as every turn of the blade backwards or forwards, opens the upper angle of the wound, when the aqueous humour immediately escapes, and the iris not only falls close against the posterior surface of the blade, but, sometimes even under the edge, so as to throw the young operator into the greatest embarrassment. If the point of the knife has now been favourably brought out, the surgeon is to continue to push it on, without pressing it downwards, or making a sawing motion

with it, until the last stage of the operation, viz. that in which the incision is finished. However, as soon as the point of the knife has passed out of the cornea, and reached the inner canthus, attention must be paid, first, to that part of the blade which is yet in the anterior chamber, so that the iris may not fall under its edge, and the knife may not take an erroneous direction; secondly, to the point of the knife, which continually projects more and more, so that the inner canthus may not be wounded, which accident, though trivial in itself, would make the unprepared patient suddenly and involuntarily draw back his head. The only way of preventing this injury, says Beer, is regularly to incline the handle more backwards and downwards, in proportion as the point passes further out of the anterior chamber. Thirdly, at the period, when the last piece of the cornea is to be cut, the knife should be pushed on very slowly, for otherwise the lens, and with it a part of the vitreous humour may be discharged, as now the muscles of the eye are acting, and compressing this organ with the greatest force, and in old persons especially, the loose conjunctiva, after the cornea is cut through, comes against the knife, and is apt to be wounded. At the time, when the operator finishes the incision in the cornea, the assistant is to let the upper eyelid cover the eye, and a few seconds are to be allowed for the patient to recover from his fright.

In the second stage of the operation, Beer directs the assistant again steadily to hold the patient's head in the same manner, as during the cutting of the cornea; but, the upper eyelid, he says, must be carefully and effectually raised, without touching the eyeball in the least, or letting the ends of the fingers project beyond the edge of the tarsus. The operator is to depress the lower eyelid with his forefinger, which is not to be removed away from the eye, but gently applied to the lower part of it with the intervention of the eyelid, by which means, the cataract-lance, or capsule-needle, may be more readily and easily introduced under the flap of the cornea into the pupil, while the gentle pressure, and the projection of the cataract thereby produced, considerably enlarge the pupil, and facilitate the proper division of the capsule. In order to complete the latter object, the surgeon introduces one of the sharp edges of the capsule-needle, with the point directed towards the inner canthus, between the cornea and the iris, the wound in the former of these membranes being opened as little as possible, lest the atmospheric air enter the eye, a circumstance, of which Beer entertains great apprehension. After the capsule needle has been cautiously passed to the inferior margin of the pupil, its lower sharp edge is to be applied to the capsule of the lens with its point directly upwards, and one of its flat surfaces towards the inner; and the other, towards the outer canthus. The operator is now strictly to cut through the capsule, by making at small distances from

one another repeated perpendicular strokes with the edge of the needle. Then the handle of the instrument is to be half turned round on its axis, and similar strokes are to be made with its edge in a somewhat oblique direction, by which means, the anterior layer of the capsule will be cut into many squarish fragments, some of which, in the third stage of the operation, are taken out of the eye together with the cataract, and the risk of a secondary cataract of the anterior layer of the capsule is in a great measure removed. When the capsule-needle has done its business, it is to be withdrawn from the eye in the same position in which it was introduced, and the second stage of the operation is thus finished, (*Beer, B. 2, p. 369.*)

I believe no better instructions, than the foregoing, can be delivered, respecting the most advantageous method of dividing the capsule. They are infinitely better than those given by Wenzel and Ware. As soon as the point of the cornea knife had arrived opposite the pupil, Wenzel used to incline it gently backward, and thus puncture the capsule; but, Mr. Ware very properly objected to this plan, which, however it might serve to exhibit the dexterity of the operator, was attended with no advantage to the patient, and could not be so efficient and safe as the mode of making the division of the capsule a distinct part of the operation.

Indeed, Wenzel himself did not recommend opening the capsule of the crystalline, in every instance, at the time of cutting the cornea. In cases, where the pupil is much contracted, and where the muscles of the eye and eyelids are easily thrown into convulsions, it is improper, says he, to puncture the capsule when the section of the cornea is making. This is also improper when the space, between the crystalline, and the iris, termed the posterior chamber, is large. In all such cases, Wenzel acknowledged, that it is better simply to divide the cornea in the first instance, and then to puncture the capsule with a different instrument.

Wenzel and his father used to employ, for this purpose, a flat needle, one line, that is, one-twelfth part of an inch in diameter, having its cutting extremity a little incurvated. This needle, which they advised to be made of nealed gold, in order that its pliability may allow the operator to bend it in different directions, as occasion requires, is fixed in a handle, two inches and a half in length, and similar to that of the cornea knife. At the other extremity of the same handle, a small curette, or scoop is fixed, made also of nealed gold, which is of use for extracting the cataract.

The late Mr. Ware's method of opening the capsule will be hereafter noticed.

When the incision in the cornea has been completed, and the capsule effectually divided, the cataract, as Beer observes, advances into the pupil immediately behind the capsule-needle, and, if there be the least action in the eye itself, it is generally at once

discharged. Under these very favourable circumstances, however, it sometimes happens, that a portion of the gelatinous or scabrous surface of the cataract is detached at the margin of the pupil, as the opaque body is passing out, and, therefore, in the second stage of the operation, Beer recommends having Daviel's scoop always ready, which is to be substituted for the capsule-needle, and employed for preventing the loose fragments from falling back into the posterior chamber in the following manner: as soon as the operator remarks, that, in the passage of the cataract out of the pupil, a portion of it will be scraped off by the edge of that opening, he should introduce the scoop at the lower and outer edge, of the cataract upwards, between the cornea and the iris, so as to be able to keep the part of the cataract, which is ready to break off, close up behind the rest of it, and bring the whole out of the eye.

But, says Beer, when the third stage of the operation, viz. the removal of the cataract from the eye, cannot be so readily accomplished, a circumstance, not always owing to an imperfection in the incision in the cornea, or in the division of the capsule, but sometimes proceeding from a want of proper action in the eye itself; the operator, if he feels convinced that the fault does not lie in the first or second stage of the operation, (in which case, it would be necessary to endeavour to rectify what is wrong,) should assist in promoting the discharge of the cataract. There are two manners of doing this, and it is not a matter of indifference which is selected; for, the second should be adopted only, when the first will not answer. Hence, says Beer, the operator, like a skilful accoucheur, must first trust to the action of the organ itself, which he should in a certain degree excite, and not proceed immediately to the use of a scoop, hook, or forceps. The eye is to be suffered to turn quickly a few times upwards, and in general, during these movements, the surgeon will perceive, that the lower edge of the cataract advances further through the pupil, and at length, slips out of the eye, without the aid of instruments. If at this period, a portion of the cataract were found to be likely to break off, the employment of Daviel's scoop, in the way already explained, would be proper. On the other hand, if, during the protracted movements of the eye upwards, this organ evince little energy of its own, the cataract will not enter the pupil, or scarcely do so, much less pass out of the eye, and the operator is under the necessity of resorting to manual assistance, and with the end of the finger used for keeping the lower eyelid depressed, he is gently to press the lid against the lower part of the eyeball. Such pressure should be gradually increased, until the greatest diameter of the cataract has passed into the pupil, at which moment, the pressure must not be discontinued, before the cataract is completely out of the eye, which object may be promoted by supporting the lower part

of the lens with Daviel's scoop, and then the pressure is to be diminished in the same gradual way, in which it has been previously augmented. Immediately the cataract is completely out of the eye, and the surgeon has paid due attention to the removal of any fragments left behind, the assistant is to let the upper eyelid descend, the patient is to be desired to keep both his eyes shut and perfectly still, and his head and eyes are to be covered with a clean white piece of linen, so that the effect of the light may be moderated.

When the patient has recovered from the alarm, which, according to Beer, the passage of the cataract outwards, especially when it is large and firm, always produces in a greater or lesser degree, he is to be placed with his back towards the window, and the linen is to be raised a little from the eye, which is to be very slowly opened, while the other eye, which has not been operated upon, is to be kept well covered. Beer says, that the patient should then be shown some objects, not of a shining, or very bright description, at different distances; and, if he is able to see them plainly, the surgeon may proceed to apply the dressings without delay.

Beer confesses, that, if possible, it would be better to dispense altogether with making any trials of the power of the eye, which has just been operated upon, because such attempts must tend to increase the subsequent inflammation in the organ; yet, he is of opinion, that these trials of the eyesight are necessary after extraction of the cataract. First, because the capability of seeing immediately, is a thing always expected by the patient and his friends, and leaving them in ignorance on this point, would keep up an anxiety, likely to have a bad effect in rendering the ophthalmia more severe. Secondly, Beer urges, as a stronger motive for the custom, the circumstance of the patient seeing, when his eye is first opened, all, even the smallest objects, though he suddenly loses the faculty of distinguishing them at all, or sees them very obscurely; and, now, if he be half turned with his face towards the window, one will find in the pupil, which directly after the passage of the cataract was perfectly clear, some soft or firm fragments of the lens, which are first dislodged from within the capsule by the variations in the eye, produced by the inspection of different objects at different distances, and which, without these trials of vision, would be long in being loosened by the aqueous humour, and might form a secondary lenticular cataract; which will not now be the case, as the surgeon can and ought at once to remove them. (*Lehre von den Augenkr. 2 B. p. 373.*)

The preceding mode of operating, as Beer observes, will not answer for every case of cataract, adapted to extraction; but, the plan sometimes requires to be modified according to circumstances. Thus, according to the same writer, when the eye is very prominent, and particularly when at the

same time the fissure of the eyelids is extremely narrow, the incision in the cornea must not be made horizontally, but obliquely outwards; for otherwise the edge of the lower eyelid will retard the healing of the wound, and an ugly cicatrix, more or less injurious to the eyesight, be the consequence.

When the cataract is of middling consistence, neither very hard, nor soft, Beer assures us, that the attempt ought to be made to extract the cataract and the capsule together at the same time, as formerly recommended by him. (*Methode den grauen Staahr sammt der Kapsel auszuziehen, &c. Wien. 1799.*) In such a case, he says, the experiment will mostly succeed, if properly conducted, and, if it should not, it causes not the slightest detriment to the eye, nor the least obstacle to the effectual completion of the operation. In order to accomplish what is desired, the capsule-needle is to be introduced into the pupil, as in the second stage of the operation, and its point is then to be slowly pushed, as far as its greatest diameter, into the centre of the lens, so that one surface of the needle may be upwards, the other downwards; one of its cutting edges turned towards the inner canthus, the other towards the outer one. And now the needle, with the impaled cataract, is to have sudden, but short perpendicular jerks communicated to it, by which means, the upper and lower connexions of the capsule with the neighbouring textures will be in part loosened. The needle is next to be suddenly rotated, without withdrawing it from the cataract, so that one of its flat surfaces may face the inner canthus, the other, the outer one; and one of its edges may be turned upwards, the other, downwards; and then the short sudden jerks of the needle in the horizontal direction may be repeated, for the purpose of breaking, as much as possible, the lateral connexions of the capsule. Lastly, the capsule-needle is to be quickly withdrawn from the eye, when it is mostly followed by the lens and the capsule, or the cataract comes away fixed on the point of the instrument, at which moment the pupil becomes perfectly clear and black. When the cataract does not follow the withdrawing of the needle, the surgeon is to proceed with the usual cautions to the third stage of the operation. Great as the advantage would always be of extracting the cataract, together with its capsule, it is plain, that the attempt is not practicable when the case is a very hard lenticular cataract, because the capsule-needle cannot be effectually introduced into the body of such a lens, situated upon the yielding vitreous humour. Nor would the plan answer, if the cataract were very soft, as the movements of the needle in it could have no effect in breaking the connexions of the capsule.

In the case described by Beer under the name of *encysted cataract*, the capsule must not be opened; but after properly opening the cornea, if the cataract does not escape of itself at this moment from the eye, the

operator must immediately introduce the small cataract-tenaculum, with its point turned downwards, between the cornea and the iris, into the pupil. The cataract should then be firmly taken hold of with the hook, and slowly and steadily drawn out of the eye with its thick, tough capsule. Beer says, that extraction should be performed in the same way in the dry-husked capsulolenticular cataract of children and adults, except that, in all these cases, a fine, elastic, sharp, silver, or golden spatula, fixed at the lower part of Daviel's curette or scoop, should be ready at hand to assist in separating the cataract from the vitreous humour, immediately the opaque substance is disposed to pass out of the eye. Also in the completely fluid cataract, when the capsule is partially opaque and thickened, a circumstance easily known by appearances, the same mode of extraction must be attempted. But, if the hook should tear its way out, and the capsule empty itself, the extraction must be performed altogether with the forceps. The latter instrument is to be cautiously introduced in the same manner as the capsule-needle into the pupil, one of the largest and thickest portions of the capsule are then to be taken hold of, and suddenly drawn out towards the opposite side, by which means, generally the whole anterior layer, and sometimes also the posterior layer of the capsule will be detached, and the pupil immediately cleared. On the contrary, in what Beer has called the *bar cataract*, which, he says, is seldom fit for an operation, as soon as the cornea has been opened, the bar must first be separated, by means of the capsule-needle, from the uvea, in whatever way is found most practicable, and then it is to be extracted with the small cataract-tenaculum, or teeth forceps; when this has been done, the cataract itself must be taken out of the eye in the same manner as the encysted cataract. (B. 2, p. 377.)

When extraction has been completed, the next object is to dress the eye; while the patient turns his eye upwards, the lower eyelid is to be drawn downwards from the eye with the fore-finger, and steadily held so, until the patient has shut his eye as much as possible. At this moment, Beer applies a small strip of adhesive plaster, perpendicularly over the fissure of the eyelid, a practice very properly not imitated in this country; and then a doubled piece of fine linen, which is fastened on the forehead with a common bandage. Both eyes he dresses in the same manner, even when only one has been operated upon.

Mr. Ware found, that a dossil of lint, steeped in plain water, or brandy and water, and covered with the spermaceti, or saturnine cerate, and removed once every day, is the most easy and convenient dressing, that can be applied after the operation. The cerate over the lint prevents the latter, when impregnated with the discharge, from becoming stiff, and irritating the lids. Mr. Ware thought the mode of applying the compress and bandage over the eye, a circumstance

of no small importance, because, if too loose, the dressings are very apt to slip off, and, consequently, to press unequally and injuriously on the eye; and, if too tight, the undue pressure will excite pain and inflammation, and even force out some of the vitreous humour. Mr. Ware's compress is made of soft linen, folded, two or three times, wide enough to cover both eyes, and sufficiently long to extend from the upper part of the forehead to the lower part of the nose. This he pins at the top of the patient's night-cap; and its lower part, which is divided in the middle, to allow the nose to come through it, he lays loosely over the eyes. The bandage, also made of old linen, and as broad as six fingers, he carries round the head over the compress, and pins to the side of the night-cap moderately tight. A slip of linen is afterwards carried under the chin, and pinned at each end to the side of the bandage, so as to prevent it from slipping upwards. (Ware.) Beer recommends the patient to lie upon his back, with his head not too low, and in a chamber which is not too light, and to remain in this way at least until the wound in the cornea is closed. As, during the first two days after the operation, the doubled piece of linen, which Beer places over the eye, is repeatedly wet through with the discharged aqueous humour, it is to be changed several times a day, care being taken to let the fresh pieces of linen be well aired and warmed. With respect to the after treatment, Beer also enjoins the observance of every thing, which has been already pointed out as proper after depression and reclination; and, in particular, while the wound in the cornea is not firmly healed, and the eye cannot be kept open, the patient must refrain from taking snuff and smoking tobacco. According to the same author, no thoughts should be entertained of opening the eye again, till two or three days after the discharge of the aqueous humour has completely ceased; a circumstance always indicated by slight prickings in the eye itself, by a burning, though not very severe, pain, attending the escape of that fluid from the inner canthus, and in irritable, nervous, debilitated subjects, even by the sensation of transient luminous appearances. Therefore, Beer says, the eye should seldom be opened before the 5th, or 6th day. When this is first done, the light should be very moderate, and the patient placed with his back towards it, all unnecessary lateral light being kept from the eye by the linen attached to the forehead, while the daily trials of the newly recovered powers of the eye should be made with the utmost precaution. On the 8th, 9th, or at latest, on the 10th day, Beer recommends leaving the eye open, but screened above by a green eye-shade, in a half darkened chamber; and he is afterwards to be treated, until his eye is perfectly well, according to the rules already laid down as proper to be observed after couching. And, especially when the patient has had cataracts in both eyes, Beer thinks it as well to apprise him, in order to prevent un-

necessary alarm, that, upon first going out into the open air, particularly in the evening, he will be for some moments almost blinded, and then begin to see again, but every object will now appear covered with a white, shining circle, which at length goes off; though, in the open air, it will sometimes continue for several days. (*B. 2. p. 380.*)

The late Mr. Ware published an inquiry into the causes preventing the success of extraction of the cataract.

The first, which he considers, is making the incision through the cornea too small. In this circumstance a degree of violence will be required to bring the cataract through the wound: and, if the cataract be not altered in its figure, the wound will be forcibly dilated, and the edge of the iris compressed between the cornea and the cataract. In this way, either some of its fibres may be ruptured, or it may be otherwise so much injured, as to excite a considerable degree of inflammation, and even induce, in the end, a closure of the pupil.

This accident may arise from the operator's cutting the cornea, without being able to see exactly the position of this membrane, in consequence of the eye having turned inward, owing to its not being properly fixed. The fault may also proceed from the incision having been begun below the transverse diameter of the cornea. In this manner, nine-sixteenths, or rather more than half of the circumference of this membrane, will not be divided; which extent the incision ought always to occupy, in order to allow the cataract to be extracted with facility.

When however the cornea is remarkably flat, and the iris projects unusually forward in the anterior chamber, Mr. Ware recommends including only one-third of the cornea in the first incision, and afterwards enlarging the aperture, on the outer side, by means of curved scissors.

Taking care to fix the eye in Mr. Ware's way, is represented by this author as being of great consequence in hindering the wound in the cornea from being made too small.

Whenever the wound in the cornea is made too small, it should always be enlarged before proceeding further in the operation; and, according to Mr. Ware, this can be best accomplished with a pair of curved blunt-pointed scissors, on the outer side of the cornea, where the knife first made its entrance.

For doing this, Beer recommends the use of Daviel's scissors, which are to be introduced with their concavity towards the operator, and their point directed towards the pupil. Beer also introduces the point of the inner blade into the middle of the wound of the cornea, under the flap already made, and passes it somewhat higher than the place to which it is necessary to enlarge the incision. Then he first conveys the instrument to the inner or outer angle of the wound, where the dilatation is to be made, keeping the blade which is within the cor-

nea, not parallel to the iris, but in an oblique position with respect to it, for otherwise the best scissors will fail to make a clear division. The scissors also must not be opened more, than is absolutely necessary, and they should be very quickly shut, and in such a manner, that the outer blade ought only to move towards that within the cornea, lest the eye suffer injury. Beer says, that it is hardly ever necessary to enlarge the incision in the cornea at both its angles; and, in these cases, he confesses, that all idea of shaping the wound altogether as it ought to be, must be renounced. (*Lehre von den Augenkr. R. 2, p. 282.*)

Wounding the iris with the cornea-knife, is the second accident, which Mr. Ware considers. The principal cause seems to him to be a discharge of the aqueous humour, before the knife has passed through the cornea low enough to hinder the lower part of the iris, which forms the inferior rim of the pupil, from getting beneath the edge of the instrument. According to Mr. Ware, the escape of the aqueous humour may be owing to some inaccuracy in the shape of the knife, or unsteadiness in introducing it. The falling of the lower part of the iris under the edge of the knife, Mr. Ware believes, cannot always be prevented by the utmost skill, or precaution of the operator. Happily, however, says he, we have been taught, that the iris may be reinstated, after it has been thus displaced, and without suffering any injury, by making gentle frictions on the cornea, with the point of the finger.

By unsteadiness in passing the knife, Mr. Ware means, that the knife may not only be suffered to make a punctuation through this tunic, but, that its edge may, at the same time, be unintentionally pressed downward, so as to make an incision likewise; in consequence of which downward motion of the knife, an aperture must unavoidably be left in the cornea, through which the aqueous humour will escape. If the cornea knife increase through its whole length, both in width and thickness, and if it be merely pushed through the cornea, no space will be left, through which any fluid can escape.

According to Beer, the escape of the aqueous humour, as the knife passes across the anterior chamber, may happen with, or without any fault on the part of the operator, and the iris fall not merely against the posterior surface of the knife, but even project under its edge, and over its back. When this happens, Beer joins Ware in recommending the end of the middle finger, situated at the inner canthus, to be gently pressed without delay upon that part of the cornea, which is in front of the knife, and, at the moment, when this is done, the iris will recede from the edge of the instrument, and the operator, by being very quick, may proceed again without any risk of injuring that part of the eye. But, if the iris should be found to project again above and below the knife immediately the point of the finger is removed from the cornea, such removal should not be made, and the knife be

boldly pushed on until its point pierces the other side of the cornea; or, if the point has already passed some way out of the cornea towards the inner canthus, the blade is to be pushed on so far, that no protrusion of the iris is possible. For, says Beer, while the finger continues to make gentle pressure upon the cornea, the iris will not fall under the knife. Should the eye chance to withdraw itself from the knife, after this has penetrated the anterior chamber; a circumstance, which may easily happen in restless timid patients, the greater part or the whole of the aqueous humour is immediately discharged, and the iris comes in contact with the empty cornea. In this case, Beer says, that the operator should find out the wound with another knife, and with a wriggling motion of the instrument, conduct it between the iris and the cornea, twisting and turning the point about until it has successfully passed beyond the external, then beyond the inner pupillary margin of the iris, and has finally come out of the cornea again. Now the incision in the cornea may be properly finished, in doing which, it is always necessary to keep the middle finger applied to this membrane, in consequence of the disposition of the iris to fall against the knife. Beer mentions it as a curious fact, that most of the patients, who are restless and unmanageable at the first introduction of the knife, and who themselves cause that disagreeable occurrence now spoken of, are, on the contrary, very quiet during the foregoing manoeuvres. (*Lehre von den Augenkr. B. 2, p. 381.*)

The third accident, noticed by Mr. Ware, is the escape of the vitreous humour. The common occasion of this occurrence is the undue application of pressure. It may take place, either when the incision is made through the cornea, or at the time of extracting the cataract. Some eyes are subject to spasm, which renders them much more liable to this accident. To prevent it, Mr. Ware recommends every kind and degree of pressure to be taken from the eye, before the knife has completely cut its way through the cornea. And, as soon as the knife has proceeded sufficiently low to secure the iris from being wounded, the operator should not only take heed, that his own fingers do not touch the eye, but should also direct the assistant, who supports the upper lid, to remove his fingers entirely from this part. The assistant seldom need make any pressure on the globe of the eye: however, when there is room for one of his fingers to be placed on the inner and upper part of the globe, without interfering with those of the operator, the method may be followed, in order to make the eye still more fixed. But immediately the *puncturation* of the cornea is completed, the assistant's finger should always be entirely removed both from the eyelids and eye itself.

Notwithstanding the upper lid is left thus free, there will be sufficient space between it and the lower lid, to allow the progress of the knife to be seen; and, in finishing the

wound, the operator should depress the lower lid with great gentleness.

The vitreous humour may also be lost, in consequence of opening the capsule of the lens nearer the circumference, than the centre of the pupil. As the crystalline is both thinner and softer at that part, the instrument will be liable to pass through both sides of the capsule, and enter the vitreous humour. This humour having no longer any barrier to its escape, is liable to be forced out by the action of the eyelids alone; and, when pressure is afterwards made, to bring the cataract through, a much greater quantity will be lost, and the cataract, instead of coming forward, will recede from the pupil. The only way to extract it now, is, by letting the upper lid be gently raised by an assistant, (a rare instance, in which this is necessary after cutting the cornea) while the operator, either with the fore-finger of the left-hand, or with the blunt end of the curette, applied beneath the incision in the cornea, prevents the cataract from sinking further. Then, with his right-hand, let him introduce a hook under the flap of the cornea, and with its point carefully entangle the cataract, and bring it away.

To prevent, however, such difficulties, Mr. Ware never attempted to puncture the capsule, until the whole pupil was in view. He was in the habit of opening the capsule with a gold-pointed needle, arched towards its extremity. Wenzel's needle, for this purpose, was flat in its extremity: Mr. Ware's pointed; and this is their only difference. The latter introduced his instrument under the flap of the cornea, with its arched part uppermost, until its point was on a level with the centre of the pupil. The end of the instrument was then turned inward, and gently rubbed on the capsule of the crystalline, until it pierced it. In a few instances, Mr. Ware found the capsule so tough, that the point of the gold needle would not enter it, and he was obliged to use a sharp steel instrument, of the same shape as that with a gold point. As already explained, Beer was much bolder with the capsule than Ware, and there can be little doubt, that both his capsule-needle and mode of using it are better, than those of Wenzel and Ware.

The vitreous humour may also be lost, at the time of extracting the cataract, and the usual cause is an undue application of pressure. All violent pressure is quite unnecessary for forcing out the cataract, when the wound in the cornea is sufficiently large. When the wound is too small, it should be enlarged as above-directed. If pressure be continued at all after the cataract is extracted, the capsule of the vitreous humour will certainly be ruptured, and some of this part of the eye protrude. Pressure may even rupture the capsule of the vitreous humour, before the cataract is brought through the incision in the cornea; the same consequences will ensue; and the same practice be necessary, as in the case, in which the operator has unskillfully opened the capsule

of the vitreous humour with the needle, in attempting to open that of the lens.

In taking away fragments of opaque matter from the pupil, by means of the curette, great care is requisite to avoid wounding the posterior part of the capsule of the crystalline with the end of the instrument, so as to open a way for the escape of the vitreous humour.

The vitreous humour may, indeed, be forced out, after the extraction of the cataract, merely by a spasmodic action of the eyelids. On this subject, Mr. Ware, after hinting his suspicion, that, in a case of this kind, which he saw, the assistant's keeping up the lid contributed to the event, repeats his advice, "that the upper eyelid should be raised solely by the fingers of the left-hand of the operator," after cutting the cornea.

Mr. Ware seems to think, that more evil has resulted from the operator's being deterred, by the readiness, with which the vitreous humour continues to start out, from ascertaining, that all the fragments of the cataract are removed, and that the whole of the iris has resumed its position, than from the mere loss of the vitreous humour, which is quickly regenerated.

When a portion of the vitreous humour protrudes, Beer thinks, that the safest practice is not to meddle with it, though he owns, that, in this circumstance, the wound heals slowly, and is always followed by a more or less perceptible, whitish scar, the pupil being generally drawn towards it, and deformed, while the iris and the partly emptied membrana hyaloidea become adherent to the edges of the incision in the cornea. But, says Beer, the eyesight will be but little, or not at all impaired, notwithstanding one-eighth or one-fourth of the vitreous humour may be lost. However, he observes, that when one-third or half of it has escaped, a good degree of vision afterward cannot be expected; and when more than half has been lost, the operation will have a still less successful result. He states also, that, when two-thirds have been lost, though the eye may recover its natural form, the pupillary edge of the iris will remain contracted round the empty, light-gray membrana hyaloidea, which projects into the anterior chamber, consequently, the pupil will be closed, and that state of the iris ensue, which is aptly termed a *sinking of the pupil, subsidentia pupillæ or synchysis*.

Mr. Ware notices the accident of extracting only a part of the cataract, and leaving the remainder behind. He is an advocate for removing all opaque substances from the pupil, except an extreme degree of irritability, to which some eyes are subject, should render the introduction of every sort of instrument, after the cataract is extracted, difficult and dangerous. Mr. Ware usually removed opaque portions of the cataract by means of a curette; and, occasionally, when the opaque substance was large, and adherent to the capsule, he was obliged to extract it with small forceps. Before finishing the operation, Mr. Ware approves of always

rubbing the end of the finger gently on the forepart of the eye, over the eyelids; which proceeding tends to bring into view any opaque matter, which may previously lie behind the iris. Mr. Ware relates a case, proving, that such opacities, as cannot be removed in the operation, are capable of being absorbed.

When, notwithstanding the observance of the directions laid down by Beer, as explained in the previous columns, some of the pul-taceous, or scabrous surface of the cataract is detached, and continues behind in the posterior chamber, Beer says, that it ought to be immediately removed, lest the patient be left with a secondary lenticular cataract, which, he observes, is not always so certain of being dissolved and absorbed, as some imagine. The fragments may be removed in two ways; and, first, the experiment of rubbing the upper eyelid over the eye should be made, because it not unfrequently brings the remains, especially when they are gelatinous, completely through the pupil, and out of the incision in the cornea. But, if such manœuvre should not be effectual, Beer recommends cautiously introducing Daviel's curette to the outer pupillary edge of the iris, with its concavity towards the inner surface of the flap of the cornea, without raising this flap unnecessarily high, and then the operator is to endeavour to scoop out at once as much of the opaque matter as he can, and bring it to the inner surface of the cornea. He says, that it will rarely be necessary frequently to repeat the introduction of the curette. (B. 2, p. 387.)

According to Mr. Ware, an opacity of the capsule can be the only reason for removing it. The anterior part, he says, can alone become the object of the operator's attention: its posterior part is necessarily hidden, while the cataract remains in the eye, and afterward, if discovered to be opaque, it is so closely connected with the capsule of the vitreous humour, that Mr. Ware believes it cannot be removed by any instrument, without hazarding a destructive effusion of this humour.

When, however, the opaque lens is accompanied with an opacity in the front part of the capsule, Mr. Ware recommends the following plan. After cutting the cornea, as usual, a fine pointed instrument, somewhat smaller in size than a round couching-needle, and a little bent towards the point, should be introduced under the flap of the cornea, with its bent part upward, until its point is parallel with the aperture of the pupil. The point should then be turned toward the opaque capsule, which is to be punctured by it, in a circular direction, as near to the rim of the pupil as the instrument can be applied, without hurting the iris. Sometimes, the part included within the punctures, may be extracted on the point of the instrument; and, if this cannot be done, it should be removed with a small pair of forceps. The lens, whether opaque or transparent, should next be extracted, by making a slight pressure with

the curette, either above, or below, the circumference of the cornea.

On the preceding subject, Beer remarks, that when none of the lens itself is left behind, but there is a slight degree of opacity in the anterior layer of the capsule, easily distinguishable from the cut flakes, and producing the least obstacle to vision, the opaque membrane should be taken away with the forceps, in the manner described in the preceding pages; for, otherwise a secondary capsular cataract will follow, which will become of a snow-white colour, and if only a trivial degree of iritis take place after the operation, it will become adherent to the iris, and the pupil become contracted and disfigured. (*B. 2, p. 388.*)

Beer does not agree with Ware in condemning all attempts to remove the posterior layer of the capsule, when found opaque, after the extraction of the lens. The case, he says, is indicated by the light gray speckled appearance of the whole pupil, and by the patient seeing nothing at all, or objects only indistinctly in a thick mist. Beer advises a cataract-tenaculum to be passed into the pupil, in the same way as the capsule-needle is introduced in the second stage of extraction, directing its point downwards as it enters, and upwards when it is brought out again. After it has entered the pupil, it is to be made to divide and annihilate, by repeated turns of the tenaculum, the back layer of the capsule, and also the membrana hyaloidea, directly behind it, which, in such a case, is always adherent, and opaque. Of these membranes a considerable part, closely wound round the hook, may be taken out of the eye, though never without some slight loss of the vitreous humour. In cases of this kind, the patient ought to be informed, that, though his sight will be restored, a part of the cataract must be left, and will be visible behind the pupil, particularly when it is dilated; for, otherwise, suspicions may arise, that the operation has been badly done, and a relapse apprehended. (*B. 2, p. 388.*)

Mr. Ware has considered the bad consequences of allowing foreign bodies of any kind, after the operation, to press unequally on the globe of the eye; comprehending, under this head, the intervention of the edge of the lower eyelid between the sides of the divided cornea; the inversion of the edge of the lower eyelid; and the lodgment of one, or more, loose eyelashes on the globe of the eye.

To prevent the first accident, every operator, before applying the dressings, should carefully depress the lower eyelid; and, before he suffers the lid to rise, should take care that the flap of the cornea be accurately adjusted in its proper position; and, that the upper lid be dropped, so as completely to cover it. After this, the eyelids should not be opened again, for three or four days; that is, until there is a good reason to suppose the wound in the cornea closed. (*Ware.*)

The inversion of the lower eyelid is hurt-

ful, in consequence of its making the eyelashes rub against the eye. These should be extracted the day before the operation. For the mode of effecting a permanent cure, see *Trithiasis*.

Besides the danger, to which the eye is exposed, from the inversion of the edge of the lid, the eye may receive injury from the improper position of the eyelashes alone; one or more of which, during the operation, may happen to bend inwards; or, becoming loose, may afterward insinuate themselves between the inside of the lid and the eye. An eyelash bent inward, should be rectified; if broken off and loose, it should be removed.

Mr. Ware lastly considers prematurely exposing the eye to a strong light. He censures the plan of opening the eyelids, within the first two or three days after the operation, because the stimulus of the light increases the ophthalmia, and the methods apt to disturb the wound in the cornea, before it is closed. Mr. Ware, however, wishes it not to be inferred, that he is an advocate for long confinement after the operation. His mode is to keep the patient wholly in bed, and to direct him to move his head as little as possible for the first three days after the operation. During this time, a dossil of wet lint is kept on his eyes, covered with a saturnine plaster, compress, and bandage, as already described. The dressing is renewed once every day, and the outsides of the eyelids washed with warm water in winter, and cold in summer. At each time of dressing, the skin of the lower lid is drawn gently down, to prevent any tendency to an inversion. Animal food is prohibited, and the patient enjoined not to talk much. On the fourth day, he is permitted to sit up for two or three hours, and, if he has had no stool since the operation, a mild opening medicine is now administered. On the fifth, the time of his sitting up is lengthened, and, presuming that the wound in the cornea is now closed, Mr. Ware usually examines the state of the eye. After this, no dressings need be applied in the daytime, care being taken to defend it from a strong light, by a pasteboard hood, or shade, and by darkening the room, so that no inconvenience is felt. The patient may now also look, for a short time, at large objects. The following part of the treatment need interfere very little with the wishes of the patient, unless unexpected accidents should occur. (*Ware.*)

As Beer, observes, if the patient be very restless, make frequent attempts to open his eye in the least, and partly lie upon the eye, or if in changing the compresses the greatest caution be not used, the eye will perhaps be roughly pressed upon, and the iris protrude between the displaced and half-opened edges of the incision in the cornea, to which it will become adherent during a slow and very seldom violent inflammation. From the moment when the iris thus interposes itself between the sides of the wound, the aqueous humour begins to collect, and at length pushes the iris considerably for

wards. In this case, Beer recommends carefully opening the eye in a very moderate light, and adopting the expedients formerly mentioned, for the purpose of making the iris recede. The dressings should be re-applied, and the eye kept closed and very quiet for at least eight or ten days, so as to hinder a recurrence of this disagreeable accident. But if the iris should be already adherent to the edges of the wound in the cornea, the eye incapable of bearing light, and the aqueous humour more or less accumulated in the anterior chamber, Beer says, every thing must be left to time, while the eye is kept lightly covered for about a fortnight, and the existing inflammation properly treated. Then, if the protrusion or staphyloma of the iris should not be diminished, by the means calculated for lessening the inflammation, caustic, or the knife must be employed. (*Beer, B. 2, p. 391.*) The same causes which have been above specified as conducive to a protrusion of the iris, may also produce a discharge of the vitreous humour.

The following observations by Beer are interesting: when the dressings have been unskillfully applied; when the incision in the cornea has been made horizontally upon a large prominent eye; when the fissure of the eyelids is exceedingly narrow; or the patient is restless; a proper cicatrization of the wound in the cornea may not follow. Though the aqueous humour may collect in the anterior chamber, the partially united lamellæ of the cornea may be incapable of duly resisting the distention of that fluid, and consequently protrude in the form of a light-gray, semi-transparent, oval vesicle, extending nearly the whole length of the wound in the cornea, and being most prominent in the centre. The patient complains of an annoying sense of pressure in the eye, as in cases of protrusion of the iris; but the discharge of the aqueous humour has completely stopped, and therefore the anterior chamber presents its natural appearance, and the pupil its regular round shape, though the edges of the wound in the cornea are whitish and swollen. This case was formerly regarded as a prolapsus of the membrane of the aqueous humour; but Beer considers it as a sort of hernia of the cornea, termed *ceratocoele*. Merely puncturing, or cutting away the cyst is of no service; for, though the aqueous humour immediately flows out, the wound soon closes again, and the tumour reappears, attended also with some risk of the iris falling into the cyst, and becoming adherent to it. Effectual relief cannot be obtained, unless the tumour be removed with Daviel's scissors, as close as possible to the wound; the dressings skilfully arranged; and the eye kept closed and quiet for eight days, or a fortnight. In such a case, a whitish scar is always permanently left. (*Beer, B. 2, p. 393.*)

Beer observes, that when the pupil contracts very considerably after the incision in the cornea is made, and the cataract at

the same time remains at some distance from the uvea, too small an opening has generally been made, and it ought to be enlarged. But if the cataract cannot be forced through the pupil, without making pressure on the lower part of the eyeball, and the closure of the pupil should still continue, the circumstance proceeds from the loss of the aqueous humour, and the second stage of extraction must be deferred a little while until the pupil dilates again, and the operation must then be finished in a very moderate light.

When, in the second stage of the operation, the anterior layer of the capsule has been properly divided, and yet the cataract will not pass into the pupil, though the eye itself acts with energy, Beer says, that it is indispensably necessary to make pressure upon the lower part of the eyeball, as already advised, and to continue it either until the cataract with its lowermost edge effectually projects through the pupil and out of the eye, or until it is moved so far directly upwards, (without entering the pupil,) that its lower margin is brought into view, and quite a black semilunar interspace is seen between it and the inferior pupillary edge of the iris. At this moment the operator, without increasing the pressure of the finger on the eyeball, lest the vitreous humour burst, and a great part of it be lost, and without lessening the pressure, lest the cataract sink back into the eye, should introduce Daviel's curette into the above interspace, with its hollow surface applied against the back surface of the cataract, which is to be gently pushed out of the eye. In doing this, Beer owns that a small part of the vitreous humour is almost always lost, but the quantity is not at all comparable to what is lost when the hyaloid membrane gives way before Daviel's curette is introduced, which can then only be passed into the eye through the protruded vitreous humour for the purpose of pushing out the cataract.

Beer notices the occasional protrusion of the iris, in the third stage of the operation, more or less between the edges of the incision in the cornea, immediately after the exit of the cataract. Here, says Beer, the iris should be reduced without the least delay, and the pupil, which is completely oval, made round again; a thing which the operator may easily perform, by applying his hand flat upon the patient's forehead, letting the latter shut his eye, rubbing the upper eyelid quickly, yet gently with the thumb, and then suddenly opening the eye, by which means a moderate light will all at once strike it, and induce an expansion of the iris.

In all patients who have been operated upon for cataracts, the edges of the eyelids become glued together with mucus on the first night after the operation; yet, according to Beer, in individuals particularly subject to copious secretions of mucus, it is not unusual for the puncta lachrymalia and lachrymal ducts to be blocked up with thick-

ened mucus, whereby the tears are prevented from duly passing down into the nose, so that from time to time they are discharged from the inner angle of the eye, and collect under the eyelids. In this case the patient soon begins to complain of a violent, continual, and increasing sense of pressure on the eye, and the upper eyelid swells, unattended with any redness. Irritable persons also experience a stupefying dull headach. These inconveniences may be immediately removed by clearing away the mucus with a little lukewarm milk from the inner canthus, and letting a stream of clean water fall over the cheek. Care must also be taken to hinder a recurrence of the circumstance again, and to remove it if it should happen.

The inflammation, consequent to extraction, chiefly affects the iris and neighbouring textures. Beer refers its origin principally to the entrance of air into the interior of the eye; which, owing to the size of the wound, he says, is not entirely to be prevented. But another cause is the introduction of different instruments into the eye, and hence the inflammation is generally severe, when it has been necessary to remove fragments of the cataract with Daviel's curette, or to take away the capsule with forceps, or destroy it with the tenaculum-needle. However, Beer is of opinion, that a surgeon, who knows how to operate well in every mode, will not find the inflammation, under these circumstances, more violent after extraction, than other methods, and therefore, he thinks, that, when no considerable impediment exists, it should be preferred. Beer, who considers extraction as a radical mode of removing a cataract, thinks, that when there are no great and insurmountable obstacles to its performance, and the operator can execute it as well as all other methods, and with the requisite skill, it ought to be preferred. But when he is deficient in skill, he is himself the greatest impediment to the success of the operation. The particular cases, in which the methods of depression and reclinatio are indicated, have been already specified, and in these, of course, extraction is not advantageous. There are also some examples, as Beer remarks, in which the latter operation must be hazardous for a beginner, and therefore, in respect to such an operator, by no means eligible, as in cases of *bar-ataract*, and *capsulo-lenticular cataracts with a cyst of purulent matter*. (Beer, B. 2, p. 396.)

OF KERATONYXIS.

The etymology and meaning of this term will be found in its place in this dictionary. This operation requires the pupil to be first artificially dilated. It admits of being divided into two stages; first, the introduction of the needle through the cornea and pupil as far as the cataract; and, secondly, the breaking of the lens to pieces, and the division and laceration of its capsule. For these purposes, Beer prefers a common

straight, spear-shaped, sharp-edged couching-needle to any curved-one, however fine it may be made; first, because it pierces the cornea, with greater facility; secondly, because both a soft cataract and the capsule can be more effectually cut with it, a larger opening being made, through which the aqueous humour may flow over the fragments of the lens, and the dissolution of the cataract be thus rendered more certain; whereas, with a curved needle, Beer says, the lens can only be disturbed, and the capsule torn, under which circumstances, inflammation and a secondary capsular cataract is likely to be produced. He directs the instrument to be introduced either at the lower, or at the external part of the cornea, one line and a half from its margin, the point being directed obliquely towards the pupil, and the capsule is to be effectually cut by moving the extremity of the needle laterally in various ways; and, above all things it is necessary at the time of breaking the lens piecemeal, not to let the instrument continue always within this body, but, at every stroke, to lift it completely out of the lens and capsule, and then introduce it into them again in different directions.

As Beer observes, this method of operating must soon have been found as little adapted to all cataracts, as any other mode; for, otherwise, the suggestion would not have been made to practise *reclination* through the cornea. To this form of reclination, however, Beer adduces great objections; for, he says, that, in this manner, either the cataract cannot be properly turned, if the iris be duly spared; but it will continue to lie obliquely, being always quite evident below the pupil, and very apt to rise again from the slightest cause; or it is indeed depressed far enough towards the bottom of the eye, but, however much the pupil may be artificially dilated, the pupillary edge of the iris is more or less injured, especially with the convexity of a curved needle. In addition to these considerations, Beer urges against this method all the objections, which apply to the practice of reclination through the sclerotic.

After the lens and capsule have been effectually cut in pieces, the same light mode of dressing and the same after-treatment are proper, which are adopted in cases of depression and reclination. Beer also particularly objects to any trials being immediately made of the eyesight. At the same time, he assures us, that he has not met with any of the instances, so frequently mentioned in books, of persons, on whom keratonyxis has been done, seeing perfectly well, and having quite a clear pupil in a few days: under the most favourable circumstances, several weeks, and sometimes as many months, elapsed, before the pupil became quite transparent.

According to Beer, keratonyxis is not liable to many accidents. Sometimes, says he, the artificially dilated pupil contracts, as soon as the needle has pierced the cornea, and reached the cataract: in this circumstance,

the operator must wait quietly, until the pupil gradually expands again, a change, which may be promoted by screening the eye with the hand. If the operation were to be continued without delay, either the pupillary edge of the iris would be seriously and dangerously hurt by the needle, or the cataract could not be effectually divided. When, contrary to expectation, the nucleus of the cataract is too hard to be broken piecemeal, reclinaton and depression should be done through the cornea, as well as circumstances will allow, and these objects can be more easily effected with a part, than with the whole, of the lens. When the lens is found completely fluid, but the capsule opaque only at some points, Beer, with a view of preventing a secondary capsular cataract, recommends cutting the membrane in all directions, and annihilating it as much as possible. Keratonyxis may be followed by the same evils, which occasionally take place after depression and reclinaton, and which will require similar treatment. But, according to Beer's experience, one of the most frequent consequences is a secondary capsular cataract, which often ensues even though the pupil was quite clear at the time of the operation, and though it may not quite blind the patient, it considerably lessens his power of vision, and renders the operation very incomplete.

When the sole object of keratonyxis is to break and cut the cataract and its capsule piecemeal, and the fragments are to be left to dissolve and to be absorbed, the operation can be indicated only where this division, breaking, dissolution, and absorption of the cataract, can be successfully wrought. Hence, Beer sets down the method as not calculated for firm, hard, lenticular cataracts; nor for those which are softish and scabrous only upon their surface; and, he says, that it is not suited for capsulo-lenticular cataracts, nor for any cases, termed false cataracts, which are of a membranous nature. Keratonyxis, he observes, may be expected to answer only in fluid or gelatinous cataracts, when the capsule is either little or not at all opaque and thickened, and of course can be easily opened and cut to pieces, as in the case described under the name of encysted cataract. For the above reasons, the method is well adapted for children and young subjects, in whom the origin and general complications of a cataract involve the case in suspicious circumstances.

Langenbeck, who has practised keratonyxis to a considerable extent, thinks extraction preferable to it only when the whole cataract can be brought out at once, by means of gentle pressure on the eye, and with the aid of Daviel's curette, as in the case of a firm cataract; while he represents keratonyxis as most advantageous, where, by the manœuvre of opening the capsule, the mass of the cataract would be so divided by the instrument as not to admit of being extracted altogether; but, would require the use of a scoop, forceps, or hook for bringing out the fragments, as in examples of soft,

milky, and capsular cataracts. Langenbeck also urges, as a reason against extracting soft cataracts, their greater size, whereby in their passage through the pupil in an entire state, they may injure the iris. (*Neue Bibliothek für die Chir.* 1. B. p. 461.) Valuable information on keratonyxis has been published by the same author in the 4th vol. of his first Bibliothek, in the 1st vol. of his new Bibl. p. 1, &c. 1815; and in a tract entitled, "*Prüfung der Keratonyxis einer Methode den grauen Staar durch die Hornhaut zu recliniren, oder zu zerstückeln nebst erläuterten Operations geschichten.*" Göttingen. 1811. See also G. H. Buchorn's *Diss. de Keratonyxide*; Halz.

OF THE CONGENITAL CATARACT, AND OPERATING UPON CHILDREN.

I shall not stop here to inquire, whether the expression *congenital cataract* is generally used with strict propriety; but, it is worth noticing, that the term is reprobated by Beer, as being in general incorrectly applied.

So much has been already said in a preceding section of this article, concerning the propriety and striking advantages of operating for the cataracts of children, that to expatiate further upon this point would be a mere waste of time.

We have noticed the case, which Scarpa terms the *primary membranous cataract*, and which is mentioned by that distinguished professor, as being met with in children, or young people, under the age of twenty, the substance of the crystalline itself being almost entirely absorbed, while the capsule is left in an opaque state, including, at most, only a small nucleus, not larger than a pin's head. This disease is described by Scarpa as being exceedingly rare, and characterized by a certain transparency, and similitude to a cobweb; by a whitish opaque point, either at its centre, or circumference; and by a streaked and reticulated appearance. Now, this example, which is represented by Scarpa as being rare, appears, from the experience of Mr. Saunders, to be by no means uncommon, since, at the London Infirmary for curing diseases of the eye, it has been found, that the majority of congenital cataracts are capsular, or membranous. This last statement is also at variance with that of the late Mr. Gibson, who has asserted, that, in infants, the cataract is generally fluid. (*Edinb. Med. and Surgical Journal*, Vol. 7, p. 397.) Mr. Ware also asserts, that, in children, born with cataracts, the crystalline humour has generally, if not always, been found either in a soft, or fluid state. (*Obs. on the Cataract, and Gutta Serena*, Vol. 2, p. 380.) However, as Mr. Saunders must have had the most experience in these particular cases, I believe, we must consider his account as the most accurate. We learn from this last gentleman's publication, that, in the congenital cataract, after the crystalline lens is converted into an opaque substance, it is gradually absorbed; and, in proportion to the progress of absorption,

the anterior lamella of the capsule approaches the posterior, until they form one membrane, which is white, opaque, and very elastic. This process is commonly completed long before the eighth year, and the operator will now find a substance, which he will in vain endeavour either to extract or depress. But, there is one form of the congenital cataract, in which the absorption of the lens does not proceed, viz. when the centre of the crystalline is opaque, and its circumference is perfectly transparent. Should the capsule and lens be penetrated, however, with any instrument, the

opacity soon becomes complete, and from this moment, the substance of the lens begins to be absorbed.

The experience of Mr. Saunders proves, that, in the congenital cataract, the lens may be either solid, soft, or fluid, but, that more frequently it is partially, or completely absorbed, and the cataract is capsular.

The following table of forty-four cases is given in Mr. Saunders's work, for the purpose of showing in what proportion each species of cataract has been found to prevail in congenital cases.

Solid opaque lens, with or without opacity of the capsule. Three single, two double cataracts	6
Solid lens, opaque in the centre, transparent in the circumference, with capsule in the same state. Five double	5
Soft opaque lens, with, or without opacity of the capsule. Two single, two double	4
Soft opaque lens, with solid nucleus. One single, two double	3
Soft opaque lens, with dotted capsule, the spots white, the spaces transparent. Two double	2
Fluid cataract, with opacity of the capsule. Two single	2
Fluid cataract, with opacity of the capsule, and closed pupil. Two double	2
Opaque and thickened capsule, the lens being completely absorbed, or the remains of it being thin and squamose. Six single, twelve double	18
Opaque and thickened capsule, with only a very small nucleus of the lens unabsorbed in the centre. Two single	2
Opaque and thickened capsule in the centre, remains of the lens in the circumference. One double	1

Here the corresponding character of congenital cataracts in the eyes of each individual is exhibited by the number of double cases, and we are informed, that the same character was preserved in the cataracts of several children of the same family. (*Saunders on Diseases of the Eye, edit. by Dr. Farre, p. 135, 136*)

The congenital cataract appears frequently to afflict several children of the same parents. In the course of the present article, I have already had occasion to advert to two striking examples of this fact. The first is related by Mr. Lucas, who attended five children of a clergyman at Leaven, near Beverley, all born with cataracts. (See *Med. Obs. and Inquiries, Vol. 6.*) The second is mentioned by Mr. Gibson, who some years ago, saw five or six children, the families of two sisters, who were all totally blind, and in an idiotic state, having cataracts accompanied with amaurosis. (*Edinb. Med. and Surgical Journal, Vol. 8, p. 398.*) Several instances occurred to the late Mr. Saunders. In one family, two brothers were thus afflicted. In a second family, two brothers, twins, became blind with cataracts at the age of twenty-one months, each within a few days of the other. It is re-

markable, that the four cataracts had precisely the same character. In a third family, a brother and two sisters were born with this disease. The eldest sister was affected with it only in one eye, the brother and youngest sister in both eyes. In a fourth family, three brothers and a sister had all congenital cataracts. (*Saunders on the Diseases of the Eye, p. 134, 135.*)

Children with congenital cataracts possess various degrees of vision; but, when they are totally blind, their eyes not being attracted by external objects, volition is not exercised over the muscles of these organs, which roll about with an irregular, rapid, and trembling motion.

I shall now proceed to speak of the manner of operating upon children. Until the time of Mr. Pott, the intention of surgeons, in couching, or depressing the cataract, (as indeed the expression itself implies,) was to push the opaque crystalline downward, away from the pupil. Mr. Pott, conscious that the cataract often existed in a fluid, or soft state, was aware that it could not then be depressed; and, therefore, in such cases, he recommended using the couching needle for the express purpose of breaking down the cataract, and of making a large

aperture in the capsule, so that the aqueous humour, which he believed to be a solvent for the opaque crystalline, might come into immediate contact with this body. This operation, subsequently to Mr. Pott, has been strongly and ably recommended by Mr. Hey, of Leeds, and Professor Scarpa, of Pavia. In the cases of children, it even received the approbation of the late Mr. Ware, who informs us, that he and his son had performed a similar operation on a considerable number of infants and young persons with uniform success. (*On the Operation of Puncturing the Capsule of the Crystalline Humour*, p. 9.)

But, notwithstanding the utility and efficacy of lacerating the front layer of the crystalline capsule had been so much insisted upon by Scarpa and others, their observations were confined to the cataract in the adult subject, and, before the example set by the late Mr. Saunders, no one (excepting, perhaps, Mr. Gibson of Manchester) ventured to apply, as a regular and successful practice, such an operation to the eyes of infants and children. Indeed, it seems highly probable, that even Mr. Gibson himself would have remained silent upon the subject, had not his attention been roused by the reports of the London Institution for curing diseases of the eye, which reports, he says, were dispersed and exhibited in the public news rooms of Manchester. For the creation and perfection of this beneficial practice, therefore, I am disposed to give the memory of Mr. Saunders great honour. The propriety of operating for the cataracts of children had long ago been insisted upon by a few writers, and the attempt even now and then made; but, the method never gained any ground, until Mr. Saunders led the way.

It only remains for me to describe the plans of operating, as executed by Mr. Saunders, Mr. Gibson, and Mr. Ware.

The principle, on which Mr. Saunders proceeded in his operations on the congenital cataract, was founded on the opinion, that the only obstacle to the absorption of the opaque lens is the capsule; and that as the latter also is most generally opaque, "the business of art is to effect a permanent aperture in the centre of this membrane. This applies to every case of congenital cataract, which can occur." Mr. Saunders used to overcome the difficulty of operating upon children, by fixing the eyeball with Pellier's elevator, having the patient held by four or five assistants, dilating the pupil with belladonna, and employing a very slender needle, armed with a cutting edge from its shoulders to its point, and furnished with a very sharp point, calculated to penetrate with the utmost facility.

Before the operation, the extract of belladonna, diluted with water to the consistence of cream, is to be dropped into the eye, or, to avoid irritation, the extract itself may be smeared in considerable quantity, over the eyelid and brow. In less than an hour, if there be no adhesions, it produces a full dila-

tation of the pupil, exposing to view nearly the whole anterior surface of the cataract. The application should then be washed from the appendages of the eye.

In using the needle, Mr. Saunders most carefully abstained from doing any injury to the vitreous humour, or its capsule, and it was an essential point with him to avoid displacing the lens. In directing the extremity of the instrument to the centre of the capsule, he passed it either through the cornea, near the edge of this membrane, (the operation now called *keratonyxis*,) or through the sclerotica, a little way behind the iris. By the first, which is called the *anterior* operation, Mr. Saunders conceived, that less injury would be inflicted, and less irritation excited, than by introducing the needle behind the iris, through all the tunics of the eye. In every case, the first thing aimed at was the permanent destruction of the central portion of the capsule to an extent equal to that of the natural size of the pupil. If the capsule contained an opaque lens, Mr. Saunders used next to sink the needle gently into the body of the crystalline, and moderately open its texture; cautiously observing not to move the lens at all out of its natural situation.

When the case was a fluid cataract, Mr. Saunders was content in the first operation with simply lacerating the centre of the capsule, being desirous of avoiding to increase the irritation following the diffusion of the matter of the cataract in the aqueous humour.

When the cataract was entirely capsular, Mr. Saunders acted with rather more freedom, as he entertained in this case less fear of inflammation: but, in other respects, he proceeded with the same objects in view, which have been already related, and of which the principal consisted in effecting a permanent aperture in the centre of the capsule, without detaching this membrane at its circumference; for then the pupil would have been more or less covered by it, and the operation imperfect, "because this thickened capsule is never absorbed, and the pendulous flap is incapable of presenting a sufficient resistance to the needle to admit of being removed by a second operation." (P. 145.)

I have already explained, that Mr. Saunders found, that the greatest success attended the operation between the ages of eighteen months and four years. One operation frequently accomplished a cure; as many as five were seldom requisite.

The only particularity, in Mr. Saunders's treatment of the eye after the operation, was that of applying the belladonna externally for the purpose of making the pupil remain dilated, till the inflammation had ceased, so as to keep the edge of the iris from contracting adhesions with the margin of the torn capsule. In leaving this part of the subject, I must advise every surgeon to read the interesting account of Mr. Saunders's practice, published by his friend and colleague, Dr. Farre. Many minute particulars will be

found in this work, highly worthy of the practitioner's attention and imitation.

Mr. Gibson appears to have been unacquainted with the usefulness of the extract of belladonna in preparing the eye for the operation. A few hours before operating, he was in the habit of ordering an opiate, sufficient to produce a considerable degree of drowsiness, so that the infant generally allowed its eyelids to be opened, and properly secured without resistance, and was little inclined to offer any impediment to the introduction of the couching needle; but, on the contrary, presented the sclerotica to view, naturally turning up the white of its eye. If the infant was more than a year old, and whenever it was necessary, Mr. Gibson used to introduce its body and arms into a kind of sack, open at both ends, and furnished with strings to draw round the neck, and tie sufficiently tight round the legs, so that its hands were effectually secured, and the assistants had only to steady its body, and fix its head, whilst the child was laid on a table, upon a pillow. Mr. Gibson never found it necessary to use a speculum, having uniformly experienced, that, after the couching needle was introduced, he had no difficulty in commanding the eye, aided by a slight degree of pressure upon the eyeball with the index and middle fingers of his left-hand, which were employed in depressing the lower eyelid. He admits, however, that the speculum can easily be applied, if an operator prefer it. He generally used Scarpa's needle, because, in infants, the free rupture of the capsule of the lens ought commonly to be aimed at, in order that the milky cataract may escape, and mix with the aqueous humour; or, if the cataract be soft, that the aqueous humour may be freely admitted to its pulpy substance which has been previously broken down with the needle. He thinks, that no peculiarity is necessary in depressing the hard cataract of infants. Before Scarpa's needle was known in this country, Mr. Gibson used Mr. Hey's, which was generally effectual, and, as he conceives, possesses the recommendation of being less liable to have its point entangled in the iris. He says, that, when a milky cataract has been thus evacuated, it renders the aqueous humour turbid; but, that, within the space of two days, the eye generally acquires its natural transparency, and vision commences. When the capsule and substance of the soft cataract have been broken down, and the aqueous humour has come into contact with the lens, the solution and disappearance of the cataract, in all the cases, upon which Mr. Gibson has operated, have uniformly taken place in a short time. The experience of Mr. Gibson curiously differs from that of Mr. Saunders in one respect: he assures us, that although he has met with cataracts in infants hard enough to bear depression, yet that *he has never met with a simple membranous cataract*; though this is no uncommon occurrence in patients at the age of eight, or ten, as well as in adults, who have been blind from

birth. (See *Edinb. Med. and Surgical Journal*, Vol. 8, p. 398, 399.)

For the purpose of fixing the eye, Mr. Ware considered Pellier's elevator requisite in operating upon infants. When the patient, however, had advanced beyond the age of infancy, Mr. Ware sometimes fixed the eye by means of the fingers alone. For the purpose of puncturing the capsule, and breaking down the cataract, this gentleman gave the preference to an instrument, which resembles one recommended by Cheselden, for the purpose of making an artificial pupil; but it is somewhat narrower. Its blade indeed is so narrow, that it nearly resembles a needle. Its extremity is pointed, and it cuts on one side for the space of about the eighth of an inch, the other side being blunt. It is perfectly straight; is an inch long in the blade; and forms a complete wedge through its whole length. Upon one side of the handle is a coloured spot, by attending to which, the operator may always ascertain the position of the instrument in the eye.

Mr. Ware dilated the pupil with the extractum belladonnæ, softened with a little water, and applied about half an hour before the time of operating. This gentleman believed, that in operating upon infants, the surgeon might perform the operation with more composure, if the patient were laid upon a table, with the head properly raised on a pillow. The bent end of Pellier's elevator should be introduced under the upper eyelid, and the instrument committed to the care of an assistant. If the right eye is to undergo the operation, and the surgeon operate with his right hand, he must of course sit or stand behind the patient; and, in this case, he will himself manage the speculum with his left-hand. The eye being thus fixed, Mr. Ware passed the point of the narrowed-bladed knife above mentioned through the sclerotica, on the side next to the temple, about the eighth of an inch from the union of that membrane to the cornea, the blunt edge being turned downwards. The instrument was pushed forwards in the same direction, until its point had nearly reached the centre of the crystalline. The point was then brought forwards, until it had passed through the opaque crystalline and its capsule, and was plainly visible in the anterior chamber. If the cataract was fluid, and the anterior chamber became immediately filled with the opaque matter, Mr. Ware deemed it advisable to withdraw the instrument and defer further measures until the matter was absorbed, which absorption usually took place in the course of a few days, and sometimes of a few hours. If no visible change were produced in the pupil, the point and cutting edge of the instrument were applied in different directions, so as to divide both the opaque crystalline and its capsule into small portions, and, if possible, bring them forwards into the anterior chamber. This may require the instrument to be kept in the eye for a minute or two; but, if the operator preserve his steadiness, he may continue it there a much

longer time without doing the least injury to the iris, or to any other part. If the cataract be found of a firm consistence, (though this rarely happens in young persons,) it may be advisable to depress it below the pupil; and in such a case particular care should be taken to perforate largely the posterior part of the capsule, and to withdraw the instrument immediately after the cataract has been depressed in order to hinder it from rising again. If the opacity be in the capsule the instrument will not act so easily upon it as it does on the opaque crystalline; but, notwithstanding this, the capsule as well as the crystalline, may be divided by it into larger or smaller portions, which, when thus divided, will be softened by the action of the aqueous humour; and though in the first operation on such case, says Mr. Ware, it may not be possible to remove the opacity, yet, on the second or third attempt, the divided portions may be brought forwards into the anterior chamber, in which place, they will then be gradually absorbed, and soon disappear. After the operation, Mr. Ware seldom found it necessary to take away blood from children, or persons under the age of twenty. He continued a cooling antiphlogistic treatment a few days. After this, if any opaque matter remained, he expedited its absorption by dropping a small portion of powdered sugar into the eye once or twice a day. When, at the end of a week or ten days, the inflammation was over, and the pupil obstructed with opaque matter, Mr. Ware advised a repetition of the operation. After a similar interval, the operation, he says, may be requisite again. In most cases, Mr. Ware was obliged to operate twice; in a few instances, once proved sufficient; and only in three, out of the last twenty, did he find it necessary to operate a fourth time. (*On the Operation of Puncturing the Capsule of the Crystalline Humour.*)

I think any impartial man, who considers the practice of the three preceding operators, will find great cause to admire the superior gentleness and skill, which predominate in the operations of the late Mr. Saunders. For my own part, I am so fully convinced of the mischief, which has been done to the eyes, by the rash boldness, awkwardness, and unsteadiness of numerous operators, that, it appears to me, the inculcation of gentleness and forbearance in all operations for the cataract, is the bounden duty of every man, who has occasion to write upon the subject. Great manual skill, and invariable gentleness, indeed, seem to me to have had more share in rendering Mr. Saunders's operations successful, than any particularity either in his method or his instrument. I have no hesitation in declaring my own partiality to the principles, on which his practice was founded, and my belief, that they are well calculated to improve most materially this interesting branch of surgery. Consult particularly *Celsus De Re Medica*. *J. H. Freytag, De Cataracta,*

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CATHETER. (from *καθίμι*, to thrust into.) A tube which is introduced through the urethra into the bladder, for the purpose of drawing off the urine. (See *Urine, Retention of*.) Of course, there are two kinds of catheters; one, intended for the male, the other, for the female urethra. With respect to catheters, three things are to be considered: 1st, the instrument itself; 2d, the manner of introducing it; and 3d, the conduct to be pursued after its introduction.

Catheters were anciently composed of copper: Celsus knew of no other kind. As these, however, had the inconvenience of becoming incrustated with verdigris, they at length fell into disuse, and others, made of silver, were substituted for them. This change, which was made as early as the time of the Arabian practitioners, still receives the approbation of the best modern surgeons. The common catheter is a silver tube, of such a diameter as will allow it to be introduced with ease into the urethra, and of various figures and lengths, according as it is intended for the young or adult, the male or female, subject. For an adult female subject, it should be about six inches long; and, for young girls, four or five. For men, the length ought to be from ten inches and a half to eleven inches. But, as

the instrument need not enter far into the bladder, Mr. John Bell's advice to avoid too great a length, merits observance. (*Principles of Surgery*, Vol. 2, p. 193.) As the urethra in some instances is narrow, and, in others wide, surgeons should be furnished with catheters of different diameters. The choice of the instrument, in respect to its width, is likewise determined very much by the nature of the disease of the urethra. (Langenbeck, *Bibl. E. 1*, p. 1177.) For a woman, the diameter ought to be at least two lines; and, for girls, a line and a half. For male adult subjects, Desault recommends the thickness of two lines and one-third; and, for boys, that of a line and a half. In general, whenever the urethra is pervious, it is better to follow the advice of Desault, and employ a largish catheter, which will enter the passage more easily, and not be entangled in the folds of the membranous lining of the canal, while it will afford a more ready outlet for the urine. On the other hand, small catheters should be preferred, when there are obstructions in the passage. Catheters also differ in shape: those which Desault used for male subjects, had only a slight curvature of one-third of their length; a curvature, which began insensibly from their straight part, and was continued to the very end of their beaks. The curvature was also regular, so as to form the segment of a circle six French inches in diameter. As the course of the urethra in the male subject is regular, the caprice evinced by surgeons in the different curvatures of their catheters, cannot be founded on any correct anatomical principles, and the bend of the instrument, (at least for subjects of the same age and stature,) should generally not vary at all, but be strictly adapted, as Langenbeck remarks, to the natural track of the urethra. (*Bibl. 1*, p. 1177.) The female catheter, however, has only a slight curvature towards its beak; a shape adapted to the direction of the meatus urinarius. Desault also improved silver catheters, by causing them to be made with elliptical openings, or eyes, at the sides of the beak, with rounded edges, instead of the longitudinal slits previously in use, in which the lining of the urethra was frequently entangled, pinched, and lacerated, so that acute pain and profuse hemorrhage were the consequences. With the view of preventing these evils, he also filled up the openings with lard. (See *Euvres Chir. de Desault*, T. 3, p. 118.)

Besides silver, or inflexible catheters, surgeons now frequently employ flexible ones, made of elastic gum. These last, indeed, are of so much importance, that they may be said to constitute one of the greatest improvements in modern surgery. I shall not here inquire, whether they were first invented by Theden, Pickel of Wurzburg, or Bernard of Paris; this is a point, which the Germans and French must settle themselves. Imperfect attempts had been made by others at earlier periods to invent catheters, possessing the property of flexibility. Van

Helmont proposed the use of catheters, made of horn; but, this substance was found to be too stiff, and to be very quickly coated with depositions from the urine. Fabricius ab Aquapendente employed leather catheters, which were objectionable, inasmuch as they were soon softened by the urine and mucus of the urethra, when they shrivelled, and became impervious. Other flexible catheters were also formerly tried, composed of spiral springs of silver-wire, covered with the skins of particular animals. These last, however, were very quickly spoiled by putrefaction; and when left in the urethra any considerable time, the beak sometimes entirely separated from the rest of the instrument, and was left behind in the bladder.

The elastic gum-catheters, now in use, are liable to none of the preceding inconveniences: they are formed of silk tubes, woven for the purpose, and covered with a coat of elastic gum; they are sufficiently flexible to accommodate themselves to the different curvatures of the urethra; they are not softened by the urine; and they constantly remain with their cavity unobliterated. Their smooth and polished surface makes them continue a long while free from incrustations deposited from the urine. Sometimes, they are introduced with astilet, or wire, which is passed into their canal, in order to give them a certain curvature, and a greater degree of firmness; but, in general, it is withdrawn as soon as the tube is in the bladder.

Elastic catheters are less irritating to the urethra, and less apt to become covered with calculous incrustations, than silver tubes: they can also be frequently introduced, when a metallic one will not pass.

The selection of good bougies and catheters, especially in operations upon the male subject, is a business of the first-rate importance, for, by employing such as are disposed to break, "many a practitioner has doomed his patient to years of dreadful, and, perhaps, hopeless suffering, and brought down irreparable disgrace upon his own head." (*Med. Chir. Journ.* Vol. 5, p. 75.) M. Nicod, in performing the operation of lithotomy upon a male found the stone, which was very brittle, one inch and a half long, and eight or nine lines thick, traversed in the direction of its greater diameter, by a piece of elastic gum catheter, which had acted as a nucleus for the deposition of calcareous matter. (See *Obs. sur le danger d'employer de mauvaises sondes de gomme elastique*; *Journ. de Médecine*, par Leroux, Oct. 1816.)

The best elastic catheters used to be fabricated at Paris, by Bernard. At the present time, the best maker in France is Feburier, orfèvre, in the Rue du Bac, No. 51, at Paris; but the elastic gum catheters now made in London are in some respects better than French, being generally much smoother and more regular, though I believe our smallest size is not yet so small, as what Feburier makes. The gum catheters are made at Paris of twelve different sizes, which corres-

pond to twelve holes in a plate of brass.

"Each catheter, therefore, (says a late intelligent visitor to that capital) has its size designated by its number, which greatly facilitates the ascertaining of the progress of the case towards a cure. Numbers 1 and 2 are smaller than can be procured in England, and are so slender, that I thought there might be danger of their breaking, until I was convinced by seeing the method of making them, that there is no reason for fearing any such thing. A firm tissue of silk is woven upon a brass stilet, of the size of the cavity of the instrument to be made. In weaving this tissue, the orifice or eye is left, and the whole therefore consists of one entire thread. The successive layers of varnish are deposited on the outer surface of the silken tissue, their number depending on the size of the instrument; and each coating of varnishing undergoes a long process of scouring before the next is put on, for which purpose women are employed by Feburier." (See *Sketches of the Medical Schools of Paris*, by J. Cross, 1815, p. 122, 123.)

According to this gentleman, however, the English gum-catheters possess advantages: "they retain their curve better without the stilet, are less liable to crack, and have eyes more smooth and better formed." (P. 124.) Bernstein, in his Dictionary of Surgery, gives the following account of this instrument, as it is fabricated in Germany: One of the most useful inventions which have been made, with respect to these instruments, is to construct them of elastic gum, and the merit of this invention is to be ascribed, without doubt, to Theden. (*Neue Bemerkungen u. Erfahrungen*, &c. Th. 2. Berlin, 1782, p. 143.) They were afterward improved by a silversmith at Paris, of the name of Bernard, who did not apply the dissolved elastic gum to a wire cylinder, as Theden had done, but to one made of knitted silk; and these catheters certainly deserve to be recommended in preference to all others. But, with respect to their price, the elastic catheters formerly prepared by Fickel, of Wurzburg, (*Richter's Chr. Bibliothek* B. 6. p. 512,) deserve particular recommendation. These consist of silk cylinders, plaited or worked upon a probe, and afterwards covered with the following varnish: three parts of white-lead, minium, or sugar of lead, with boiled linseed oil, which is the common varnish used by cabinet-makers, mixed with one part of melted amber, and the same quantity of oil of turpentine. With this varnish the silk cylinders are covered, and the same thing is repeated three times, as soon as each coating has been dried in the open air. The catheters are then put in a baker's oven twenty-four hours, when bread has been baked in it the last time, and when it retains the temp. of 60. 70. Reaum. Here they are to remain ten or twelve hours. When the catheter has been taken out of the oven, the inequalities are to be rubbed off with a little pumice-stone;

the end is to be sewed up; the oblong lateral aperture is cut in it; and it is to be coated twelve or fifteen times more with varnish. The catheter must be always well dried in the open air, before the varnish is spread upon it again, and after every third coating which it has received, it must be put in the oven again, so that it must in all have received from fifteen to eighteen coatings with varnish, and have been laid five or six times in the oven. The end is smoothed off with oil. (*Cyclopædia by Rees, Art. Catheter.*)

When the object of passing a catheter is merely to empty the bladder, without any design of leaving the instrument afterwards in the passage, Langenbeck always prefers an inflexible one, made of silver. (*Bibl. für die Chir. B. 1, p. 1176.*)

Sometimes spasm about the perinæum renders the introduction of a catheter difficult. In this case, a dose of opium should be administered, before a second attempt is made. When inflammation prevails in the passage, the introduction may often be facilitated by a previous bleeding.

The operation of introducing the catheter may be performed, either when the patient is standing up, sitting, or lying down, which last posture is the most favourable. In order to pass a catheter with ease and dexterity, the following circumstances must be observed: the instrument must be of suitable shape and size; a just idea of the perineum and curvature of the urethra must be entertained; the catheter must be introduced with the greatest care and delicacy; and the relaxation of the abdominal muscles has been insisted upon, (*Langenbeck, Bibl. 1, p. 1177.*) though, I confess, that it does not appear to me, how this circumstance is of importance.

One of the most important maxims is, never to force forward the instrument, when it is stopped by any obstacle. If there are no strictures, the stoppage of the catheter is always owing to one of the following circumstances. Its beak may be pushed against the os pubis. This chiefly occurs when the handle of the instrument is prematurely depressed. Here the employment of force can obviously do no good, and may be productive of serious mischief. The beak of the catheter may take a wrong direction, and push against the side of the urethra, especially at its membranous part, which it may dilate into a kind of pouch. In this circumstance, if force were exerted, it would certainly lacerate the urethra, and occasion a false passage. The end of the catheter may be entangled in a fold of the lining of the urethra, and here force would be equally wrong. Lastly, the point of the instrument may be stopped by the prostate gland, in which case force can be of no service, and may do great harm. Hence, it is always proper to withdraw the instrument a little, and then push it on gently in a different position.

There are two methods of introducing a male catheter, viz. with the concavity turned

towards the abdomen; or with the concavity directed downwards in the first stage of the operation. Off course, the latter plan requires the instrument to be turned, so as to place its concavity upwards, as soon as the beak has arrived in the perineum; and hence, the French surgeons call this method the "tour de maitre."

The operation may be divided into three stages. In the first, the catheter passes, in the male subject, that portion of the urethra which is surrounded by the corpus spongiosum; in the second, it passes the membranous part of the canal, situated between the bulb and the prostate gland; and in the third, it enters this gland, and the neck of the bladder.

In the first stage, little trouble is usually experienced; for the canal is here so supported by the surrounding corpus spongiosum, that it cannot easily be pushed into the form of a pouch, in which the end of the instrument can be entangled.

When the catheter is to be introduced with its concavity towards the abdomen, and the patient is in the recumbent posture, the thighs are to be separated, and the legs moderately bent. The surgeon is to draw back the prepuce, and to hold the penis between the thumb and fore-finger of his left-hand, which are to be applied on each side of the corona glandis, and not at all to the under surface of the penis, so as to avoid pressing upon the commencement of the urethra. After the catheter has been well oiled, its handle is to be held between the thumb and fore-finger of the right-hand, and to rest with the back of the little finger upon the patient's abdomen, in the vicinity of the navel. Now, while the handle is parallel to the axis of the body, the beak is to be introduced into the urethra; the penis being extended, and drawn forwards, as it were, over the instrument, while the latter is gently pushed on, until its beak has reached the arch of the pubes. When the penis cannot be drawn further over the catheter, the beak has arrived in this situation, where it stops in front of the arch, and is pressing against the posterior side of the urethra. At this particular moment, the handle is to be depressed towards the patient's thighs, and the manœuvre, well managed, generally directs the end of the catheter, at once through the prostatic portion of the urethra into the cavity of the bladder. In short, as soon as the beak of the instrument has passed under the arch of the pubes, and the surgeon very slowly brings the handle forwards, or downwards, the beak is elevated, and glides into the bladder. In this stage of the operation, the penis must be allowed to sink down, and not be kept tense, as this would only render the passage of the instrument more difficult.

The operation, however, is not always successfully accomplished in this manner. The beak of the catheter may be stopped by the os pubis; it may take a wrong direction, so as to push the membranous part of the urethra to one side or the other; or it may be

stopped by a fold of the lining of the passage.

The first kind of impediment is best avoided, by not depressing the handle of the catheter, too soon; that is, before the point has passed beyond the arch of the pubes. When the membranous part of the urethra is pushed to one side or the other, the instrument ought to be withdrawn a little, and then pushed gently on in a different direction; but, if this expedient is unavailing, the index finger of the left-hand may be introduced into the rectum, for the purpose of supporting the membranous part of the urethra, and guiding the extremity of the catheter. The passage of the catheter through the membranous part of the urethra, and especially the attempt to hit the entrance of the prostate, are the most difficult things in the operation, and also the only ones attended with risk of mischief, which is frequently produced by rough, unskilful surgeons, when they use violence, and rupture this yielding weak portion of the canal.

When the prostate gland is enlarged, the urethra makes a more sudden turn upwards, just as it approaches the bladder, than is natural. The end of the catheter, therefore, should be more bent upward, than in other cases.

In the third stage of the operation, the beak of the instrument has to pass the prostate gland and neck of the bladder. The principal obstacles to its passage, in this situation, arise from spasm of the neck of the bladder, and muscles in the perineum, and from the instrument being pushed against the prostate gland, instead of into the continuation of the urethra through it. The first impediment may generally be obviated by waiting a few moments, and gently rubbing the perineum, before attempting to push the catheter further into the passage. The hindrance, caused by the prostate, is best eluded by using an instrument the point of which is more curved, than its other part. Sometimes the surgeon himself presses the prostate towards the os pubis, by means of his finger in the rectum, and thus prevents the passage of the catheter, by increasing the sudden curvature at this part of the urethra. Hence, as Richter observes, it is a very important maxim, never to introduce the finger so far into the rectum, as to press on the prostate gland itself.

When the catheter has turned round the pubes, and is just about to enter the neck of the bladder, is the critical moment, in which may be seen, whether a surgeon can or cannot manage the operation with skill; for, if he knows how to pass the instrument, he suddenly, but not violently changes its direction. He depresses the handle with a particular kind of address, and raises the point, which, as if it had suddenly surmounted some obstacle, starts into the neck of the bladder, and the urine bursts out in a jet from the mouth of the catheter.

They, who are unskilful, press the tube forward, and persist, as they had begun, in

drawing up the penis, on the supposition that by stretching this part they lengthen the urethra, and make it straight, whereas they elongate only that part of the canal, along which the catheter has already passed. (*John Bell's Principles of Surgery*, Vol. 2. p. 213.)

When the catheter is to be introduced with its concavity downwards, or by the "tour de maitre," the beak is to be passed into the urethra, and the penis drawn over it, as it were, as in the foregoing method. In other words, the instrument well oiled, is to be introduced, with its convexity uppermost, as far as it can be, without using force. As soon, however, as the end of the catheter has reached the point, at which the canal begins to form a curve under the pubes, the surgeon is to make the penis and the instrument perform a semicircular movement, by inclining them towards the right groin, and then towards the abdomen. In the execution of this manœuvre, care is to be taken to keep the beak of the catheter stationary, so that it may be the centre of the movement, and simply revolve upon itself. This part of the operation, the object of which is to turn the concavity of the catheter upwards, ought to be done very slowly, a large sweep being made with the handle, while particular care is taken not to retract, nor move the beak from its position. The handle is then to be depressed, and the operation finished exactly in the same manner, as when the first plan is pursued. As Desault properly observes, the only circumstance, in which the two methods differ, is, that, in one, the same thing is performed by two movements, which is done in the other by one; so that the operation is rendered more difficult and painful. Hence, many judicious modern surgeons never practise the "tour de maitre," except when their patients are very corpulent or placed in the position usually chosen for lithotomy, when other modes of introducing the catheter would be less convenient.

The depth to which the catheter has entered, the cessation of any feeling of resistance to the motions of the beak, when revolved upon its axis, and the issue of the urine, are the circumstances, by which the surgeon knows, that the instrument has passed into the bladder.

According to the experience of Desault, the practice of gradually letting out a part of the urine, after the catheter has been introduced, is by no means advantageous.—He also disapproves of running into the opposite extreme, that is to say, of letting the urine flow out of the catheter, as fast as it is secreted; for, then, the bladder is kept constantly relaxed, and the detrusor muscle will not be likely to recover its tone. When the bladder is continually empty, it is liable to come into contact with the end of the catheter; a circumstance which has sometimes caused considerable irritation, pain, and even ulceration of that viscus. Besides these inconveniences, there are some others; the catheter is sooner obstructed with mu-

cus, and covered with incrustations, than when it is closed with the stilet. The patients are likewise obliged to remain in bed, where they are either wet with their urine, or compelled to have incessantly a pot for its reception. The best practice, therefore, seems to be that of letting out all the urine, as soon as the catheter is introduced, and then closing the instrument until the bladder has become moderately distended again; for experience proves, that such moderate distention and relaxation of the muscular fibres of the bladder, alternately kept up, have the same good effects upon that organ, as moderate exercise has upon other parts of the body. When a catheter is to be left in the urethra, it should always be properly fixed with a narrow piece of tape, or else it is apt to slip out, or even pass too far into the passage. For this purpose, some surgeons use cotton-thread, which they fasten to the rings, or round the external end of the catheter. The two extremities of the thread are then carried some way along the dorsum of the penis, when they are tied together, and afterwards conveyed in opposite directions round the part, till they meet underneath it, where they are tied in a bow. When a silver catheter is employed, a tape, or narrow riband is passed through each of the rings, and conveyed to each side of the pelvis, where it is fastened to a circular bandage. Mr. Hunter remarks, that the common bag-truss for the scrotum answers extremely well, when two or three rings are fixed on each side of it along the side of the scrotum, and the ring of the cannula is fastened to any of them with a piece of tape. (*On the Venereal Disease*, Ed. 2, p. 159.)—He also notices another method: when the catheter (says he) is fairly in the bladder, the outer end is rather inclined downwards, nearly in a line with the body. To keep it in this position, we may take the common strap, or belt part of a bag-truss, with two thigh straps, either fixed to it, or hooked to it, and coming round each thigh forwards by the side of the scrotum, to be fastened to the belt, where the ears of the bag are usually fixed. A small ring, or two, may be fixed to each strap just where it passes the scrotum or root of the penis; and with a piece of small tape, the ends of the catheter may be fixed to those rings, which will keep it in the bladder. It seems Mr. Hunter did not, like Desault, disapprove of leaving the catheter unclosed, and he adds, therefore, “a bit of rag, about four or five inches long, with a hole at the end of it, passed over the exterior end of the catheter, and the loose end allowed to hang in a basin placed between the thighs, will catch the water, which cannot disengage itself from the catheter, and keep the patient dry; or, if another pipe is introduced into the catheter, it will answer the same purpose. (*Op. cit.* p. 191.) But, there are numerous modes of fixing a catheter, which need not be specified; for, although they are of importance, the principles which should be observed in adopting them, are the main things to be

understood. These are, first, never to fix a catheter in such a way, that too much of the instrument projects into the cavity of the bladder; and, secondly, to be careful that the thread or tape, which is applied, will not chafe and irritate the parts.

Mr. Hey has offered some good practical remarks on the introduction of the catheter. If, says he, the point of the catheter be less turned than the urethra, the point will be pushed against the posterior part of the passage, instead of following the course of the canal. The posterior part of the urethra has nothing contiguous to it which can support it; and no considerable degree of force will push the point of the catheter through that part between the bladder and the rectum. If this accident is avoided, still the point will be pushed against the prostate, and cannot enter the bladder. Mr. Hey tells us, that the truth of this is illustrated by the assistance which is derived, whenever the catheter stops at the prostate, from elevating the point of the instrument with a finger introduced in the rectum.

Mr. Hey takes notice of the impropriety of pushing forwards the point of the catheter, before its handle is sufficiently depressed, as the point would move in a horizontal direction, and be likely to rupture the posterior side of the urethra.

The difficulty arising from the inflamed and dry state of the passage, (which difficulties I should conceive can never be great,) Mr. Hey says, may be obviated by the previous introduction of a bougie, well covered with lard.

In order to pass the catheter, Mr. Hey places his patient on a bed, in a recumbent posture, his breech advancing to, or projecting a little beyond the edge of the bed. If the patient's feet cannot rest upon the floor, Mr. Hey supports the right leg by a stool, or by the hand of an assistant. The patient's head and shoulders are elevated by pillows; but the lower part of the abdomen is left in a horizontal position. Mr. Hey commonly introduces the catheter with its convexity towards the abdomen, and having gently pushed down the point of the instrument, till it becomes stopped by the curvature of the urethra, under the symphysis pubis, he turns the handle towards the navel, pressing at the same time its point. In making the turn, he sometimes keeps the handle at the same distance from the patient's abdomen, and sometimes makes it gradually recede; but, in either method, he avoids pushing forwards the point of the catheter any farther than is necessary to carry it just beyond the angle of the symphysis pubis. When he feels that the point is beyond that part, he pulls the catheter gently towards him hooking, as it were, the point of the instrument upon the pubes. He then depresses the handle, making it describe a portion of a circle, the centre of which is the angle of the pubis. When the handle of the catheter is brought into a horizontal position, with the concave side of the instrument upwards, he pushes forwards the point, keep-

ing it close to the interior surface of the symphysis pubis; for when passing in this direction, it will not hitch upon the prostate gland, nor injure the membranous part of the urethra.

If the surgeon uses a flexible catheter, covered with elastic gum, it is of great consequence to have the stilet made of some firm metallic substance, and of a proper thickness. Mr. Hey always makes use of brass wire for the purpose. If the stilet is too slender, the catheter will not preserve the same curvature during the operation; and it will be difficult to make the point pass upwards behind the symphysis pubis in a proper direction. If the stilet is too thick, it is withdrawn with difficulty.

When the stilet is of a proper thickness, this instrument has one advantage over the silver catheter, which is, that its curvature may be increased while it is in the urethra, which is often of great use when the point approaches the prostate gland. In all cases, where an elastic gum catheter is preferred, care must be taken that it does not pass unnecessarily far into the bladder; and, if it be too long, a part of it ought to be cut off, or a shorter one employed.

When the proper manœuvres with a silver catheter do not succeed, the surgeon must change it, taking a bigger or more slender one, with a greater or less curve, according to such observations as he may have made in his first attempt. But, if the catheter has been of a good form or commodious size, yet has not passed easily, he should, instead of choosing a rigid catheter of another size or form, take a flexible one for his second attempt. The flexible catheter is generally slender, and of sufficient length, and its shape may be accommodated to all occasions, and to all forms of the urethra; for, having a stiff wire, we can give that wire either before or after it has passed into the catheter, whatever shape we please; and what is still of greater importance, we can introduce the instrument without, or with the wire, as circumstances may require; or what is more advantageous, we can introduce the wire particularly so as not quite to reach the point of the catheter, but only to within two inches or a little more of this part, by which contrivance the point, if previously warmed, and wrought in the hand, has so much elasticity, that it follows the precise curve of the urethra, and yet has sufficient rigidity to surmount any slight resistance. If this too fail, and especially, if there be the slightest reason to suspect, that the resistance is not merely spasmodic, but arises from stricture near the neck of the bladder in a young man, or swelling of the prostate in an old one, we may take a small bougie, turn up the extremity of it with the finger and thumb, so as to make it incline towards the pubes, and allowing no time for the wax to be softened, pass it quickly down to the obstruction, turn it with a vertical or twisting motion, and make it enter the constricted part. On withdrawing it in about ten minutes or a quarter of

an hour, the urine generally escapes, or the catheter may now be introduced. (*John Bell's Principles of Surgery, Vol. 2, p. 215.*)

Mr. Hey has found, that, in withdrawing the stilet of an elastic gum catheter, the instrument becomes more curved; and he has availed himself of this information by withdrawing the stilet, as he is introducing the catheter beyond the arch of the pubes, by which artifice the point is raised in the due direction.

Mr. Hey says you may sometimes, though not always, succeed in introducing an elastic gum catheter, by using one which has acquired a considerable degree of curvature and firmness, by having had a curved stilet kept in it a long while. Introduce this without the stilet, with its concavity towards the abdomen, taking care not to push on the point of the instrument, after it has reached the symphysis pubis, until its handle is depressed into a horizontal position.

When it is necessary to draw off the urine frequently, and the surgeon cannot attend often enough for this purpose, a catheter must be left in the urethra, till an attendant, or the patient himself, has learnt the mode of introducing the instrument. (*Hey.*)

Mr. Hey imputes the formation of a false passage, or the rupture of the membranous part of the urethra, generally to the method of pushing forwards the catheter, before its handle has been depressed. In this manner, the course of the instrument crosses that of the urethra, and the point of the catheter pressing against the posterior side of the membranous part of the urethra, is easily forced through the coats of that canal. The want of due curvature in the catheter, and of sufficient bluntness in its point, greatly contribute to facilitate this injury. In this case, the point of the instrument passes more readily into the wound, than onward along the urethra against the symphysis pubis. Without this pressure, the point is apt to recede, and not readily enter the membranous part of the urethra.

Mr. Hey surmounted a difficulty of this kind, by bending upwards the point of a silver catheter, so as to keep it more closely in contact with the anterior part of the urethra, and thereby pass over the wound made in the posterior side of the canal. In the instance alluded to, as it was necessary to leave an elastic gum catheter in the urethra, Mr. Hey procured some brass wire of a proper thickness, with which he made a stilet, and, having given it the same curvature as that of the silver catheter, he introduced it about four hours after the preceding operation, and fixed it by tying it to a bag truss. Mr. Hey sometimes succeeded by partly withdrawing the stilet, at the moment when he wished to increase the curvature of the catheter.

In an instance, in which the urethra had suffered a violent contusion, Mr. Hey drew off the urine with a silver catheter of unusual thickness, after he had failed with instruments of a smaller bore. He suspected that the urethra was ruptured, and was obli-

ged to raise the point of the catheter by a finger introduced into the rectum, and to use bleeding, purgatives, the warm bath, and opium, before it could be made to pass. The elastic gum catheter was afterwards employed. It is an unsettled point, whether it is best to leave the catheter in the urethra, until the power of expelling the urine is regained, or to draw off the urine twice a day, and withdraw the catheter after each operation. Mr. Hey thinks that no general rule can be laid down; some patients cannot bear the catheter to remain introduced; others seem to suffer no inconvenience from it. On the whole, however, Mr. Hey commonly prefers removing the catheter. In this manner, he is of opinion, that the power of expelling the urine again, is soonest acquired.

The preceding question is often determined by the nature of the disease, and, as Mr. Hunter observes, in cases of debility of the bladder, and where a catheter passes with difficulty, or with great uncertainty, as well as in other instances, in which it must be used frequently, and for a length of time, it will be necessary to keep it introduced, so as to allow the water to pass freely through it. (*On the Venereal Disease, Edit. 2, p. 191.*)

In France, a conical silver catheter (*sonde conique*) is frequently employed in difficult cases by Boyer, Roux, &c. This instrument has a very slight curvature, and an extremity almost pointed. By force, regularly applied, it is introduced into the bladder, in spite of all opposition. Care is taken to keep it in the centre of the passage, and the direction of its point is judged of by the position of the lateral rings. The rule mentioned by Roux, for commencing the great depression of the outer extremity of the instrument, is, when, by the finger in the rectum, the point can be felt to have reached the apex of the prostate. (*See Sketches of the Medical Schools of Paris, by J. Cross, p. 112.*) In bad cases, the conical catheter is usually allowed to remain introduced three or four days, and on being withdrawn, a small flexible gum catheter generally admits of being used.

The forcible manner in which the French surgeons employ the conical silver catheter, must often do great and dangerous mischief. Thus, in two examples, which were witnessed and examined by Roux himself after the decease of the patients, a false passage had been made, no flexible gum catheter could be passed, the urine was effused in the cellular membrane, and the parts were gangrenous. (*See p. 116 of the above work.*) According to the observation of Mr. Cross, the French surgeons employ the conical silver catheter with too little discrimination, and "in their practice they seem to make no nice distinctions between impediments to the flow of urine from spasm, irritable and inflamed state of the canal, disease of the prostate gland, and cartilaginous stricture of long duration. If the conical catheter be admissible at all, it is in the last of these cases, particularly, when combined with

fistula in perinæo; and here all surgeons, who are familiar with the treatment of diseases of the urethra, occasionally use means, which approach very closely to the forcing method of the French. I have heard of instances, in which John Hunter employed great force with the silver catheter, and overcame the obstruction. I have seen Mr. Pearson, (who generally treats strictures as mildly, and, I need hardly say, as successfully as any man) take a steel sound, and pass it gradually and forcibly on into the bladder, at the same time feeling his way, as it were, by keeping one finger in the rectum: the relief of the patient, and the ultimate cure of the disease, were the results of this practice." (*P. 118.*) It appears further, that the conical silver catheter has been used by Mr. A. Cooper. Without altogether condemning the occasional employment of this instrument, I perfectly coincide with Mr. Cross, that it is one, with which young men, of little caution and no experience, may do more harm in the first few cases they meet with, than the rest of their life will afford them opportunities of doing good.

Mr. Hunter refers to instances, in which the common catheter had been pushed through the projecting part of the prostate gland into the bladder, and the water then drawn off; but, "in one patient, the blood from the wound passed into the bladder, and increased the quantity of matter in it. The use of the catheter was attempted a second time; but, not succeeding, I was sent for. I passed the catheter till it came to the stop, and then suspecting, that this part of the prostate projected forwards, I introduced my finger into the anus, and found that gland very much enlarged. By depressing the handle of the catheter, which of course raised the point, it passed over the projection; but, unfortunately the blood had coagulated in the bladder, which filled up the holes in the catheter, so that I was obliged to withdraw it, and clear it repeatedly. This I practised several days; but, suspecting that the coagulum must in the end kill, I proposed cutting him (the patient) for the stone; but he died before it could be conveniently done, and the dissection, after death, explained the case, &c." (*On the Venereal Disease, Ed. 2, p. 172.*)

To one acquainted with anatomy, the introduction of the female catheter is exceedingly simple. From motives of delicacy to the sex, the instrument should always be passed without any exposure. The surgeon should hold the catheter in his right hand, while he introduces the fore-finger of his left-hand between the nymphæ so as to feel upon the upper surface of the passage the little papilla, which surrounds, and denotes to the touch, the precise situation of the orifice of the meatus urinarius. Holding the concavity of the catheter forward, the surgeon, guided by the fore-finger of his left-hand, is then to introduce the instrument upward into the bladder. A female catheter should always be furnished with some contrivance for preventing its slipping com-

pletely into the bladder: the following case, mentioned in a respectable periodical work, fully proves the truth of this remark.

Some years ago, a surgeon, practising in the country, was required to introduce the catheter for a lady labouring under retention of urine. During the operation, he was observed to exhibit signs of confusion, and to quit his patient in considerable embarrassment. The same day, he abruptly left his home, and was never seen afterward. The lady passed several years of dreadful suffering, attributed by herself and the professional gentleman, on whom the treatment of the case devolved, to aggravation of the original complaint. At length, an abscess presented itself in the sacral region, and the surgeon punctured it, when his instrument came in contact with some unusually hard substance imbedded in the centre of the abscess. With a pair of forceps, he now extracted to his utter astonishment a blackened female catheter. From this period, the lady's sufferings all terminated. A similar accident nearly happened in the practice of another gentleman. (See *Medico-Chir. Journ.* Vol. 5, p. 75, Lond. 1818.) (See *Urine, Retention of*.) J. Hunter, *Treatise on the Venereal Disease*. Ed. 2, in various places. Hey's *Practical Observations in Surgery*, Ed. 3. John Bell's *Principles*, Vol. 2. Ware on the Catheter. *Sketches of the Medical Schools of Paris*, by J. Cross, p. 111, &c. Jos. M'Sweeny, *Observations on the Catheter*, Edinb. Med. and Surgical Journ. No. 58, p. 52. Richter's *Anfangsgr. der Wundarzneykunst*. Rees's *Cyclopædia*, Art. Catheter. Langenbeck, 1 *Bibl. für die Chir.* B. 1, p. 1175, 12mo. Gott. 1806. Desault, *Œuvres Chir.* T. 3. The Observations on the Catheter, by Desault, Richter, J. Hunter, and Hey, are the best, with which I am acquainted.

CATLING, often spelt in surgical books, *catlin*, is a long, narrow, double-edged, sharp-pointed, straight knife, which is chiefly used in amputations of the leg and fore-arm, for dividing the interosseous ligaments and the muscles, &c situated between the two bones. The catling is frequently made too wide and large, so that it cannot execute its office with the right degree of ease.

CAUSTICS. (from *καίω*, to burn.) Medicines, which destroy parts by burning, or chymically decomposing them.

The potassa fusa (kali purum), the potassa cum calce (calx cum kali puro), the ammonium muriatum, the argenti nitras, the hydrargyri nitrico-oxydum, the acidum sulphuricum, and the cupri sulphas, are the caustics in most frequent use among surgeons.

CAUTERIZATION. (from *καυτηρίαζω*, to cauterize.) The act of burning any part with a cautery.

CAUTERY. (from *καίω*, to burn.) Cauteries are of two kinds, viz. *actual* and *potential*. By the first term, is implied a heated iron; by the second, surgeons understand any caustic application.

The high opinion which the ancients entertained of the efficacy of the actual cautery, may be well conceived from the follow-

ing passage. "Quoscumque morbus medicamenta non sanant, ferrum sanat; quos ferrum non sanat ignis sanat; quos vero ignis non sanat, insanabiles existimare oportet." (*Hipp. Sect. 8, Aph. 6.*) The actual cautery has been employed for the stoppage of bleeding, where the vessels could neither be tied, nor compressed. It has been also employed for the destruction of carcinomatous tumours and ulcers; fistulæ; polypi, and a variety of fungous diseases. Whoever looks over the writings of Hippocrates, will discover that the actual cautery was a principal means of relief in several chronic affections, as dropsies, diseased joints, &c.

In modern times, the actual cautery has been more and more relinquished, in proportion as surgery has attained a higher state of improvement. On the continent, however, it still retains advocates. In France, all the professors recommend and employ it in particular cases. The hospital gangrene, a peculiar disorder, which is much more frequently seen in foreign hospitals, is said to be little affected by any internal remedies. "Vegetable and diluted mineral acids are the local means employed with effect in mild cases: I have, (says Mr. Cross,) already alluded to a case of Pelletan's, where carbon was applied, and the progress of the disease impeded. But, the actual cautery is the only means, that has been found effectual, in stopping the fatal progress of bad cases of hospital ulcer, and the iron is applied red-hot, so as to produce an eschar on every point of the surface of the sore." (See *Sketches of the Medical Schools of Paris*, by J. Cross, p. 84.)

Desault often employed the actual cautery to destroy fungous tumours of the antrum. (See *Antrum*.) The same practice is still followed by Pelletan and other eminent surgeons in France. Mr. Cross saw it adopted in one such case with good effect. (P. 86.) That part of the fungus, which can be cut away, is to be so removed, and the deeper portion, out of the reach of the knife, is to be cauterized. If there be any case in surgery, justifying the use of a red-hot iron, it is a fungus of the antrum. But, even in this instance, I should prefer any other certain mode of destroying the root of the disease.

CERATOTOME. (from *κεράς*, a horn, and *τεμνω*, to cut.) The name given by Wenzel to the knife, with which he divided the cornea, or horny coat of the eye.

CERATUM CALAMINÆ. (L.) A good simple dressing.

CERATUM CETACEI. (L.) The spermaceti cerate. A mild, unirritating salve, for common purposes.

CERATUM CONII. R. *Unguenti Conii* lbj. (See *Unguentum*.) *Cetacci* ℥ij. *Cera Albæ*, ℥iij. M. One of the formulæ at St. Bartholomew's Hospital, occasionally applied to cancerous, scrofulous, phagedenic, herpetic, and other inveterate sores.

CERATUM HYDRARGYRI SUBMURIATIS. R. *Hydrarg. Submuriatis*, ℥i. *Cerati Lapid. Calamin.* ℥ss. M. Some practitioners are partial to this as a dressing for chancres.

CERATUM LYTÆ. (L.) This, which was lately called the cerate of cantharides, was once much used for stimulating blistered surfaces, in order to maintain a discharge. The ceratum sabinæ, however, which answers much better, and is not attended with danger of bringing on strangury, inflammation of the bladder, &c., has almost superseded the ceratum lyttæ.

CERATUM PLUMBI SUPERACETATIS. (L.) An eligible, mildly astringent, unirritating salve.

CERATUM PLUMBI COMPOSITUM. (L.) An excellent, unirritating, gently astringent salve, for common purposes.

CERATUM SABINÆ. R. *Sabinæ Recensitis Contusæ, Cera Flavæ*, sing. lbj. *Adipis Suillæ*, lbiv. Mix the savin with the melted wax and hog's lard, and strain the composition.

This is the common application for keeping open blisters, on the plan recommended by Mr. Crowther. (See *Blisters*.)

CERATUM SAPONIS. (L.) R. *Plumbi oxydi semivitrei* lib. j. *Aceti* cong. j. *Saponis unc.* viij. *Olei olivæ, Cera flavæ*, sing. lib. j.

This is the soap cerate of St. Bartholomew's Hospital. In preparing it, the utmost caution must be used. The three first ingredients are to be mixed together and boiled gently till all the moisture is evaporated; after which, the wax and oil, previously melted together, must be added. The whole composition, from first to last, must be incessantly and effectually stirred, without which the whole will be spoiled. This formula was introduced into practice by Mr. Pott, and is found to be a very convenient application for fractures, and also as an external dressing for ulcers; being of a convenient degree of adhesiveness, and at the same time possessing the usual properties of a saturnine remedy.

In applying this cerate, spread on linen, in fractures of the leg or arm, one caution is necessary to be observed, namely, that it be in two distinct pieces; for if, in one piece, the limb be encircled by it, and the ends overlap each other, it will form a very inconvenient and partial constriction of the fractured part, in consequence of the subsequent tumefaction. (*Pharm. Chirurg.*)

CERUMEN AURIS. A degree of deafness is frequently produced by the lodgment of hard dry pellets of this substance in the meatus auditorius. The best plan, in such cases, is to syringe the ear with warm water, which should be injected with moderate force.

In some instances, deafness seems to depend on a defective secretion of the cerumen, and a consequent dryness of the meatus. Here, a drop or two of sweet oil may now and then be introduced into the ear, and fomentations applied.

CERUSSA ACETATA. Sugar of lead. Acétite of lead. This preparation, which is now named by the college *plumbi superacetatus*, is well known as an ingredient in a variety of lotions and collyria. It has the qualities of preparations of lead in general,

being highly useful for diminishing inflammation.

CHALAZIUM. (from *χαλαζα*, a hailstone.) A little tubercle on the eyelid which has been whimsically supposed to resemble a hailstone. It is the same as the hordeolum or sty. (See *Hordeolum*.)

CHAMOMILE. The flowers, which are bitter and aromatic, are used in surgery, for making fomentations.

CHANCRE. (from *καρκινος*, cancer venereus.) A sore which arises from the direct application of the venereal poison to any part of the body. Of course it almost always occurs on the genitals. Such venereal sores, as break out from a general contamination of the system, in consequence of absorption, never have the term *chancre* applied to them. (For an account of the nature and treatment of chancres, see *Venereal Disease*.)

CHEMOSIS. (from *χανα*, to gape.) When ophthalmia or inflammation of the eye, is exceedingly violent, it frequently happens, that one or more vessels become ruptured on the side next the eyeball, and a quantity of blood is infused into the cellular membrane, which connects the conjunctiva with the anterior hemisphere of the eye. Hence, the conjunctiva becomes gradually elevated upon the eyeball, and projects towards the eyelids, so as to conceal within it the cornea, which appears as if it were depressed. (*Scarpa*.) In this way, the middle of the eye assumes the appearance of a gap, or aperture.

According to the late Mr. Ware, when blood is extravasated under the tunica conjunctiva, there cannot be an easier or more effectual remedy than æther. A few drops are to be poured into the palm of the hand, and diffused over it which may be immediately done by pressing the other hand against it. The hand is then to be applied to the eye, and kept close to it, while the spirit is evaporating. By this means, the action of the absorbent vessels for the dispersion of the blood is excited, and quickened.

In a few instances of chemosis, in which the swelling and inflammation of the conjunctiva have been great, the same author found the following application particularly beneficial, after free evacuations: R. *Interiorium foliorum recentium Lactucæ Sissilis*, ℥iij. *Coque cum Aq. Pur.* ℥ss. *In balneo muricæ pro semihora; tunc exprimatur succus, et applicetur paululum ad oculos et ad palpebras, saepe in die.* (Ware.)

Ophthalmia, attended with chemosis, demands the most rigorous employment of the antiphlogistic treatment. Both general and topical bleeding should be speedily and copiously put in practice, with due regard, however, to the age and strength of the patient. Leeches should be applied to the vicinity of the eyelids, or, what is preferable, the temporal artery should be opened. When chemosis is very considerable, the distention of the conjunctiva may be relieved by making an incision in it, near its junction with the cornea. (See *Ophthalmia*.)

CHEVASTER or **CHEVA'STRE**. A double-headed roller, the middle of which was applied to the chin; the bandage then crossed at the top of the head, and passed on each side to the nape of the neck, where it crossed again. It was next carried up to the top of the head, and so on, till all the roller was exhausted.

CHIA'STRE. A bandage for stopping hemorrhage from the temporal artery. It is double-headed, about an inch and a half wide, and four ells long. The middle of the roller is applied to the unwounded side of the hand; the bandage is carried round to the bleeding temple, and there made to cross over a compress on the wound. The roller is then continued over the coronal suture, and under the chin, care being taken to make the bandage cross upon the compress. In this way, the roller is applied round the head, till the whole is spent.

CHILBLAINS are the effect of inflammation, arising from cold. A chilblain in its mildest form, is attended with a moderate redness of the skin, a sensation of heat and itching, and more or less swelling, which symptoms, after a time, spontaneously disappear. The intolerable itching and sense of tingling, accompanying the inflammation of the milder description of chilblains, are observed to be seriously aggravated by exposure to heat. In a more violent degree, the swelling is larger, redder, and sometimes of a dark blue colour; and the heat, itching, and pain, are so excessive, that the patient cannot use the part. In the third degree, small vesicles arise upon the tumour, which burst and leave excoeriations. These often change into ill-conditioned sores, which sometimes penetrate even as deeply as the bone, discharge a thin ichorous matter, and generally prove very obstinate. As Dr. John Thomson has remarked, "when the serum contained in the vesications is let out by a small opening, a portion of new cuticle is usually formed to supply the place of that, which has been separated; but, when the inflammation is severe, and the affection neglected, or improperly treated, the parts, which are the seat of vesication, are liable to pass into the state of vitiated ulcers. In this state, they yield a thin, ichorous, or sanious discharge, and are in general brought, only after a long time, and with much difficulty, to a healthy supuration. In neglected cases, these ulcers not unfrequently become covered with foul sloughs. Ulceration often supervenes, and the soft parts covering the bones, are destroyed." (*On Inflammation*, p. 638.) The worst stage of chilblains is attended with sloughing.

Chilblains are particularly apt to occur in persons, who are in the habit of going immediately to the fire, when they come home in winter with their fingers and toes very cold; they are also frequent in persons, who often go suddenly into the cold, while very warm. Hence, the disease most commonly affects parts of the body, which are peculiarly exposed to these sudden transitions; for instance, the nose, ears, lips, toes,

heels, and fingers. Richter remarks, that they are still more frequently occasioned, when the part, suddenly exposed to cold, is in a moist perspiring state, as well as warm. Young subjects are much more liable to this troublesome complaint than adults; and females brought up in a delicate manner, are generally more afflicted, than the other sex.

The most likely plan of preventing chilblains is to accustom the skin to moderate friction; to avoid hot rooms and making the parts too warm; to adapt the quantity and kind of clothing to the state of the constitution, so as to avoid extremes, both in summer and winter; to wash the parts frequently with cold water; to take regular exercise in the open air in all weathers, and to take particular care not to go suddenly into a warm room, or very near the fire, out of the cold air.

Although chilblains of the milder kinds are only local inflammations, yet they have some peculiarity in them; for they are not most benefited by the same antiphlogistic applications, which are most effectual in the relief of inflammation in general.

One of the best modes of curing chilblains of the milder kind is to rub them with snow, or ice cold water, or to bathe them in the latter, several times a day, keeping them immersed each time, till the pain and itching abate. After the parts have been rubbed or bathed in this way, they should be well dried with a towel, and covered with flannel or leather socks.

This plan is perhaps as good a one as any; but it is not that which is always congenial to the feelings and caprice of patients; and with the constitutions of some it may even disagree. In such cases, the parts affected may be rubbed with spirit of wine, linimentum saponis, tinctura myrrhæ, or a strong solution of alum, or vinegar. A mixture of oleum terebinthinæ and balsamum copaivæ, in equal parts, is a celebrated application. A mixture of two parts of camphorated spirit of wine, and one of the liquor plumbi subacetatis has also been praised. Mr. Wardrop speaks highly of one part of the tincture of lyttæ, with six of the soap liniment. (*Medico-Chir. Trans.* Vol. 5. p. 142.)

With respect to vesications, "their occurrence is always hastened, and the inflammation, upon which they depend, greatly aggravated by the action of external heat; and, hence, the propriety of continuing cold applications to frost-bitten parts, so long as their temperature continues above the natural standard, or the inflammation excited seems to retain an acute character. From the tendency, which the inflammation excited, has to pass into gangrene, the more stimulating applications, such as spirit of wine, diluted ammonia, or oil of turpentine may be required. But, should these applications prove too stimulating, their strength may be weakened by additions of greater or less portions of the linimentum

ex-aqua calcis." (*Thomson on Inflammation*, p. 648.)

When chilblains have suppurated and ulcerated, the sores require stimulating dressings, such as lint dipped in a mixture of the liquor plumbi, subacetatis dilutus, and liquor calcis; tinctura myrrhæ, or warm vinegar. If a salve be employed, one which contains the hydrargyri nitrico-oxydum is best. Ulcers of this kind frequently require to be touched with the nitrate of silver, or dressed with a solution of it.

Chilblains, attended with sloughing, should be poulticed, till the dead parts are detached. The sores should then be first dressed with some mildly stimulating ointment, such as the unguentum resinæ flavæ. With this, in a day or two, a little of the hydrargyri nitrico-oxydum may be mixed; but the surgeon should not venture on the employment of very irritating applications, till he sees what the parts will bear, and whether such will be requisite at all; for, were he too bold, immediately he leaves off the poultices, he might bring on sloughing again.

The reader may find a long list of applications for chilblains in Rees's *Cyclopædia*, article *Chilblains*. See also Richter's *Anfangsgr. der Wundarzn.* Band. 1. Thomson's *Lectures on Inflammation*; p. 637, &c. Lassus, *Pathologie Chirurg.* T. 2. p. 388, &c. Léveillé *Nouvelle Doctrine Chir.* T. 4, p. 352, &c. Callisen's *Systema Chirurgiæ Hodiernæ*, Vol. 1. p. 304, &c. Edit. 1798. Pearson's *Principles of Surgery*, p. 153, &c. Edit. 1808.

CHIMNEY-SWEEPER'S CANCER.—See *Scrotum*.

CHORDEE. (French, from *χορδή*, a cord.) When inflammation is not confined merely to the surface of the urethra, but affects the corpus spongiosum, it produces in it an extravasation of coagulable lymph, as in the adhesive inflammation, which uniting the cells together, destroys the power of distention of the corpus spongiosum urethræ, and makes it unequal in this respect to the corpora cavernosa penis, and therefore a curvature takes place at the time of an erection, which is called a *chordee*. The curvature is generally in the lower part of the penis. When the chordee is violent, the inner membrane of the urethra is so much upon the stretch, that it may be torn, and a profuse bleeding from the urethra excited, that often relieves the patient, and even sometimes proves a cure.

This is the *inflammatory chordee*; there is another kind, which has been named *spasmodic*.

In the beginning of the inflammatory chordee, bleeding from the arm is often of service; but it is more immediately useful to take blood from the part itself by leeches; for, we often find, that when a vessel gives way, and bleeds a good deal, the patient is greatly relieved. Exposing the penis to the steam of hot water frequently gives great relief. Poultices have also beneficial effects; and both fomentations and poultices will often do most good when they contain camphor. Opium, given internally, is of singu-

lar service; and if it be joined with camphor, the effect will be still greater.

When the chordee continues after all inflammation has terminated, no evacuations are required; for, the consequences of the inflammation will cease gradually by the absorption of the extravasated coagulating lymph. Mercurial ointment, rubbed on the part, will considerably promote this event. When the common methods of cure are unavailing, hemlock is sometimes very useful. Electricity may be of service. A chordee is often longer in going off, than any other consequence of a gonorrhœa, but, in the end, it disappears.

For bringing about the removal of the extravasated lymph, camphorated mercurial ointment is better, than the simple unguentum hydrargyri. According to Mr. Hunter, the *spasmodic chordee* is much benefited by bark. (See his *Treatise on the Venereal Disease*, Ed. 2.)

CICATRIX. A scar: the mark left after the healing of a wound, or ulcer.

CICATRIZATION. The process by which wounds and sores heal. Granulations having been formed, the next object of nature is to cover them with skin. The parts which had receded by their natural elasticity, in consequence of the breach made in them, now begin to be brought together by the contraction of the granulations. The contraction takes place at every point, but principally from edge to edge, which brings the circumference of the sore towards the centre, so that the sore becomes smaller and smaller, even although little, or no new skin is formed.

The contracting tendency is in some degree proportioned to the general healing disposition of the sore, and looseness of the parts. When granulations are formed upon a fixed surface, their contraction is mechanically impeded; as, for instance, on the skull, the skin, &c. Hence, in all operations on such parts, as much skin should be saved as possible.

When there has been a loss of substance, making a hollow sore, and the contraction of the granulations has begun, and made a good deal of progress, before they have had time to rise as high as the skin, then the edges of the skin are generally drawn down, and tucked in by it, in the hollow direction of the surface of the sore.

The contraction of the granulations continues, till the healing is complete; but, it is greatest at first. That there is a mechanical resistance to such contraction, is proved by the assistance, which may be given to the process by the application of a bandage.

Besides the contractile power of the granulations, there is also a similar power in the surrounding edge of the cicatrizing skin, which assists the contraction of the granulations, and is generally more considerable than that of the granulations themselves, drawing the mouth of the wound together, like a purse. The contractile power of the skin is confined principally to the very edge, where it is cicatrizing, and, as Hunter be-

lieved, to those very granulations, which have already cicatrized ; for, the natural or original skin, surrounding this edge, does not contract, or at least not nearly so much, as appears by its having been thrown into folds and plaits, while the new skin is smooth and shining.

The uses of the contraction of granulations are various. It facilitates the healing of a sore, as there are two operations going on at the same time, viz. contraction and skinning.

It avoids the formation of much new skin, the advantage of which is evident ; for it is with the skin as with all other parts of the body, viz. that such as are originally formed are much fitter for the purposes of life, than those which are newly formed, and not nearly so liable as ulceration.

When the whole surface of a sore has skinned over, the substance, the remains of the granulations, on which the new skin is formed, still continues to contract, till hardly anything more is left than what the new skin stands upon. This is a very small part, in comparison with the first formed granulations, and it in time loses most of its apparent vessels, becoming white and ligamentous. All newly healed sores are at first redder than the common skin, but in time, they become much whiter.

As the granulations contract, the surrounding old skin is stretched to cover the part, which had been deprived of skin.

When a sore begins to heal, the surrounding old skin, close to the granulations, becomes smooth, and rounded with a whitish cast, as if covered with something white. This, Mr. Hunter supposed to be a beginning cuticle, and it is as early and sure a symptom of healing as any. While the sore retains its red edge all round, for perhaps a quarter, or half an inch in breadth, we may be certain, that it is not in a healing state.

Skin is a very different substance, with respect to texture, from the granulations upon which it is formed ; but it is not known, whether it is a new substance formed by the granulations, or a change in the surface of the granulations themselves.

The new skin most commonly takes its rise from the surrounding old skin, as if elongated from it ; but not always. In very large sores, but principally old ulcers, in which the edges of the surrounding skin have but little tendency to contract, and the cellular membrane underneath to yield, or the old skin to become drawn over the ulcerated surface, the nearest granulations do not acquire a cicatrizing disposition. In such cases, new skin forms in different parts of the ulcer, standing on the surface of the granulations, like little islands.

Whatever change the granulations undergo to form new skin, they are generally guided to it by the surrounding skin, which gives this disposition to the surface of the adjoining granulations.

The new-formed skin is never so large as the sore was, on which it is formed, owing to the contraction of the granulations, and

the yielding of the surrounding old skin. If the sore is situated where the adjoining skin is loose, as in the scrotum, then the contractile power of the granulations being quite free from obstruction, a very little new skin is formed ; but, if the sore is situated where the skin is fixed or tense, the new skin is nearly as large as the sore.

The new skin is at first commonly on the same level with the old. This, however, is not the case with scalds and burns, which frequently heal with a cicatrix, higher than the skin, although the granulations may have been kept from rising higher than this part.

The new-formed cutis is neither so yielding nor so elastic as the original is ; it is also less moveable. It gradually becomes, however, more flexible and loose. At first, it is very thin and tender, but it afterwards becomes firmer and thicker. It is a smooth continued skin, not formed with those insensible indentations, which are observed in the natural or original skin, and by which the latter admits of any distention, which the cellular membrane itself will allow of.

This new cutis, and indeed all the substance which had formerly been granulations, is not nearly so strong, nor endowed with such lasting and proper actions, as the originally formed parts. The living principle itself is less active ; for when an old sore breaks out, it continues to yield, till almost the whole of the new-formed matter has been absorbed, or has mortified.

The young cutis is extremely full of vessels ; but these afterwards disappear, and the part becomes white.

The surrounding old skin, being drawn toward the centre by the contraction of the granulations, is thrown into loose folds, while the new skin itself seems to be upon the stretch, having a smooth shining appearance.

The new cuticle is more easily formed from the cutis, than the cutis itself from granulations. Every point of the surface of the cutis is concerned in forming cuticle, so that this is forming equally every where at once ; but the formation of the cutis is principally progressive from the adjoining skin.

The new cuticle is at first very thin, and rather pulpy than horny. As it becomes stronger, it looks smooth and shining, and is more transparent than the old cuticle.

The rete mucosum is later in forming than the cuticle, and in some cases never forms at all. In blacks who have been wounded, or blistered, the cicatrix is a considerable time before it becomes dark ; and in one black, whom Mr. Hunter saw, the scar of a sore, which had been upon his leg when young, remained white when he was old. Many cicatrices of blacks, however, are even darker than any other parts of the skin. (*Hunter on the Blood, Inflammation, &c. The reader may also consult Thomson's Lectures on Inflammation, p. 399, &c.*)

CICUTA. See *Conium Maculatum*.

CINCHONA. As one of the designs of this dictionary is to embrace the subjects

of a surgical pharmacopœia, peruvian bark, which is administered in a multiplicity of surgical cases, cannot be passed over in silence.

Its great repute for its virtues in stopping mortifications, and accelerating the separation of the sloughs, every person, whether of the medical profession or not, has frequently heard of. Indeed, so high is the character of the medicine, that many practitioners order it in some stage, or another, of almost every distemper, often prescribe it when it is totally useless, give it when it actually does harm, and make their patients swallow such quantities as operate perniciously, when smaller doses would effect striking benefit. Some men are credulous enough to think, that from the peruvian bark vigour and strength are directly extricated, and infused into the constitution, in exact proportion to the quantity of the medicine, which the stomach will keep down and digest.

While a doctrine of this sort prevails, we must expect to see indiscriminate and erroneous practice. The generality of diseases will always be attended with an appearance of languor and weakness, and, certainly, while there exists a supposition that a drug is at hand, possessing the quality of evolving and communicating strength, it would be absurd to fancy, that so important an article will not be largely exhibited in a multiplicity of surgical cases. I shall not presume to hazard an idea of the powers of the peruvian bark in the practice of physic; but, I have not the least doubt, that they have been unwarrantably exaggerated in surgery, so as to blind and prejudice many a practitioner of good abilities, and lead him to adopt injudicious and hurtful methods of treatment.

Under particular circumstances, bark has undoubtedly the quality of increasing the tone of the digestive organs; and, of course, whenever the indication is to strengthen the system by nourishing food, and the appetite fails, this medicine may prove of the highest utility, provided it is given in moderate doses, and it appears to agree with the stomach and bowels. But, the plan of making the patient swallow as much of the medicine as can be got into his stomach, must, in my opinion, be invariably followed by bad, instead of good effects. How can it be reasonably expected, that the stomach, which is already out of order, can be set right by having an immoderate quantity of any drug whatever forced into it? In fact, if the alimentary canal were in a healthy state, must not such practice be likely to throw it into a disordered condition?

Bark is an excellent medicine, when judiciously administered; but, like every other good medicine, in bad hands, it may be the means of producing the worst consequences. How much good does mercury effect in an infinite number of surgical diseases, when prescribed by a surgeon of understanding; what a poison it becomes under the direction of an ignorant practitioner!

With respect to cases of mortification, bark is often most strongly indicated, when the sloughing is not surrounded with active inflammation, when the patient is debilitated, and his stomach cannot take nutritious food. I have always regarded the notion of giving bark, as a specific for gangrene, as totally unfounded and absurd. I have watched its effects in these cases, and could never discern that it had the least peculiar power of operating directly upon the parts, which are distempered. Whatever good it does, is by its improving the tone of the digestive organs, and making them more capable of conveying nourishment, and, of course, strength into the constitution.

I should feel myself guilty of a degree of presumption in speaking thus freely upon this subject, were not my sentiments in some measure supported by those of certain surgical writers, the remembrance of whom will always be hailed with unfeigned veneration and esteem. Mr. Samuel Sharp was not bigoted to bark, and, while he allowed it to possess a share of efficacy, he would not admit that it was capable of miraculously accomplishing every thing, which the ignorant or prejudiced alleged. "I know," says he, "it will be looked upon by many as a kind of scepticism to doubt the efficacy of a remedy so well attested by such an infinity of cases, and yet, I shall frankly own, I have never clearly to my satisfaction, met with any evident proofs of its preference to the cordial medicines usually prescribed; though I have a long time made experiment of it with a view to search into the truth."

Perhaps it may seem strange, thus to dispute a doctrine established on what is called matter of fact; but, I shall here observe, that in the practice of physic and surgery, it is often exceedingly difficult to ascertain a fact. Prejudice, or want of abilities, sometimes misleads us in our judgment, where there is evidently a right and a wrong; but, in certain cases, to distinguish how far the remedy, and how far nature operate, is probably above our discernment. In gangrenes, particularly, there is frequently such a complication of unknown circumstances, as cannot but tend to deceive an unwary observer. Mortifications arising from mere cold, compression, or stricture, generally cease upon removing the cause, and are, therefore, seldom proper cases for proving the power of the bark. However, there are two kinds of gangrene, where internals have a fairer trial; those are a spreading gangrene from an internal cause, and a spreading gangrene from violent external accidents, such as gunshot wounds, compound fractures, &c. Yet, even here we cannot judge of their effect with absolute certainty; for, sometimes, a mortification from internal causes is a kind of critical disorder. There seems to be a certain portion of the body destined to perish, and no more; of this we have an infinity of examples brought into our hospitals, where the gangrene stops at a particular point,

without the least assistance from art. The same thing happens in the other species of gangrene from violent accidents, where the injury appears to be communicated to a certain distance, and no farther; though by the way, I shall remark in this place, contrary to the received opinion, that gangrenes from these accidents, (where there has been no previous straitness of bandage,) are as often fatal, as those from internal causes.

"As I have here stated the fact, we see how difficult it is to ascertain the real efficacy of this medicine; but, had bark in any degree those wonderful effects in gangrenes, which it has in periodical complaints, its pre-eminence would no more be doubted in the one case, than in the other. What, in my judgment, seems to have raised its character so high, are the great numbers of single observations published on this subject, the authors of which not having frequent opportunities of seeing the issue of this disorder, under the use of cordials, &c. and some of them, perhaps, prejudiced with the common supposition, that every gangrene is of itself mortal, have therefore ascribed a marvellous influence to the bark, when the event has proved successful.—(*Sharp's Crit. Inq. chap. 3, on Amputation.*)

Some further remarks on this subject will be reserved for the article *Mortification*.

According to Mr. Bromfield, bark is a specific for old ulcers, where the inflammation seems circumscribed at the distance of an inch round the sore, the surface of the ulcer looks glossy, and the discharge is extremely thin and very offensive, with little or no sleep, from the violence of the pain. He further observes, that the addition of opium, as circumstances may require, will often be found necessary. (*Chirurgical Observations and Cases, Vol. 1, p. 132.*)

Bark is given so extensively in the practice of surgery, that there are few important cases, in which, in certain circumstances, and at some period or another, it is not indicated. When persons have been weakened by a course of mercury, or by the effects of any disease whatsoever, moderate doses of bark will frequently be found of great service. But, it only becomes so on the principles above suggested, and, as far as my judgment extends, this medicine should never be prescribed in any surgical cases in excessive and unreasonable quantities.

The yellow bark, or the cortex cinchonæ cordifoliæ of the new pharmacopœia, is said to possess more efficacy, than the other kinds.

CINNABAR ARTIFICIAL. (*Hydrargyri Sulphuretum rubrum.*) Is chiefly employed by surgeons for fumigating venereal ulcers. An apparatus is sold in the shops for this purpose. The powder is thrown upon a heated iron, and the smoke is conducted by means of a tube to the part affected.

CIRCUMCISION. (from *circumcido*, to cut round.) The operation of cutting off a circular piece of the prepuce, sometimes

practised in cases of phymosis. (See *Phymosis*.)

CIRSOCELE. (from *κίρσοις*, a varix, and *κύημα*, a tumour.) Cirsocele is a varicose distention and enlargement of the spermatic vein; and whether considered on account of the pain, which it sometimes occasions, or on account of a wasting of the testicle, which now and then follows, it may truly be called a disease. It is frequently mistaken for a descent of a small portion of omentum. The uneasiness which it occasions, is a dull kind of pain in the back, generally relieved by suspension of the scrotum. It has been resembled to a collection of earth-worms; but whoever has an idea of a varicose vessel, will not stand in need of an illustration by comparison. It is most frequently confined to that part of the spermatic process, which is below the opening in the abdominal tendon; and the vessels generally become rather larger, as they approach the testis. Mr. Pott never knew any good effect from external applications of any kind.

In general the testicle is perfectly unconcerned in, and unaffected by, this disease; but it sometimes happens that it makes its appearance very suddenly, and with acute pain, requiring rest and ease; and sometimes after such symptoms have been removed, Mr. Pott has seen the testicle so wasted as hardly to be discernible. He has also observed the same effect from the injudicious application of a truss to a true cirsocele; the vessels, by means of the pressure, became enlarged to a prodigious size, but the testicle shrunk to almost nothing. (*Pott's Works, Vol. 2.*)

Morgagni has remarked, that the disease is more frequent in the left, than the right spermatic cord; a circumstance which he refers to the left spermatic vein terminating in the renal. (*De Sedibus et Caus. Morb. Epist. 43, art. 34.*)

Cirsocele is more frequently than any other disorder, mistaken for an omental hernia. As Mr. Astley Cooper remarks, when large, it dilates upon coughing; and it swells in an erect, and retires in a recumbent posture of the body. There is only one sure method of distinguishing the two complaints; place the patient in a horizontal posture, and empty the swelling by pressure upon the scrotum; then put the fingers firmly upon the upper part of the abdominal ring, and desire the patient to rise; if it is a hernia, the tumour cannot reappear, as long as the pressure is continued at the ring; but if a cirsocele, the swelling returns with increased size, on account of the return of blood into the abdomen being prevented by the pressure. (*A. Cooper on Inguinal Hernia.*)

Cirsocele can for the most part only be palliated, and seldom radically cured. When the complaint is attended with pain, cold saturnine, and alum, lotions may be applied to the testicle and spermatic cord. At the same time, blood should be repeatedly taken away by means of leeches; the bowels

should be kept gently open; the patient should be placed in a horizontal posture; and the testicle should be supported in a bag-truss.

In general, the patient only finds it necessary to keep up the testicle by this kind of suspensory bandage.

Gooch, and other writers, have related cases of cirsocele, in which the pain was so intolerable and incurable, that nothing but castration could afford the patient any relief. (*J. A. Murray de Cirsocele, Upsal, 1784. Pott on Hydrocele, &c. Richter in Nov. Comment. Goett. No. 4, and in Obs. Chir. Fasc. 2, p. 22. Gooch, Chir. Works. Most, Diss. de Cirsocele, Halæ, 1796.*)

CIRSOPHTHALMIA. (from *χίρς*, a varix, and *ὀφθαλμός*, the eye.) A general varicose affection of the blood-vessels of the eye.

CLAP. (See *Gonorrhæa*.)

COLLYRIUM ACIDI ACETICI. *R.* Aceti Distillati ℥j. Spiritus Vini Tenuioris ℥ss. Aq. Rosæ ℥viij. Misce. The strength to be diminished or increased, as circumstances may require. This collyrium is recommended for weak watery eyes, and sometimes for the scrofulous ophthalmia.—(See *Wilson's Pharm. Chir. p. 66.*)

COLLYRIUM ALUMINIS. *R.* Aluminis purif. ℔j. Aq. rosæ ℥vj. This is a good astringent collyrium, employed at Guy's Hospital.

COLLYRIUM AMMONIÆ ACETATÆ. *R.* Liq. ammon. acet. Aq. rosæ. sing. ℥j. M.

COLLYRIUM AMMONIÆ ACETATÆ CAMPHORATUM. *R.* Collyrii ammon. acet. Misturæ camphoratæ sing. ℥ij. M.

COLLYRIUM AMMONIÆ ACETATÆ OPIATUM. *R.* Collyrii ammon. acet. ℥iv. Tinct. opii. gutt. xl. M.

COLLYRIUM CUPRI SULPHATIS CAMPHORATUM. *R.* Aq. Cupri sulphatis camphoratæ ℥ij. Aq. distillatæ ℥iv. M. Recommended by Mr. Ware, for the purulent ophthalmia of children.

COLLYRIUM HYDRARGYRI OXYMURIATIS. *R.* Hydrarg. oxy-muriatis gr. ss. Aq. distillat. ℥iv. M. This collyrium is fit to be employed, after the acute stage of the ophthalmia has for some time subsided, and it will disperse many superficial opacities of the cornea.

COLLYRIUM OPIATUM. *R.* Opii Extracti gr. x. Camphoræ gr. vj. Aquæ distillatæ ferventis ℥xii. Beat the two first ingredients together in a mortar, and mix the hot water gradually, and strain the fluid.

This collyrium is recommended in some ophthalmies, attended with great pain and swelling. (See *Wilson's Pharm. Chir. p. 70.*)

COLLYRIUM PLUMBI ACETATIS. *R.* Aquæ rosæ ℥vj. Plumbi acetatis. ℥ss. Misce. or, *R.* Aq. distillatæ ℥iv. Liq. plumbi acetatis. gutt. x. M. This is a good application to the eyes, when one of a gently astringent, cooling quality is indicated.

COLLYRIUM ZINCI JUPHATIS. *R.* Zinci sulphatis gr. v. Aq. distillatæ ℥iv. M. This is the most common collyrium of all; it may be made gradually stronger.

COLLYRIUM ZINCI SULPHATIS CUM MUCILAGINE SEMINIS CYDONII MALI. *R.* Aq. plantaginis ℥iv. zinci sulphatis gr. v. et mucil. sem. cydon. mal. ℥ss. M.

In order to check the morbid secretion from the eyelids, in cases of fistula lachrymalis, or what Scarpa calls *il flusso palpebrale puriforme*, this celebrated Professor recommends a few drops of the above collyrium to be insinuated between the eyelids and the eye.

COLPOCELE. (from *κολπος*, the vagina, and *κλῆη*, a tumour.) A tumour, or hernia, situated in the vagina.

COLPOPTOSIS. (from *κολπος*, the vagina, and *πτῶσις*, to fall down.) A bearing or falling down of the vagina. (See *Vagina, Prolapsus of*.)

COMA. * (from *καί*, or *καί*, to lie down.)—Anciently any total suppression of the powers of sense; but now it means a lethargic drowsiness. It is a symptom of several surgical disorders.

COMMUNUTED. (from *comminuo*, to break in pieces.) A fracture is termed *comminuted*, when the bone is broken into several pieces.

COMPRESS. (from *comprimo*, to press upon.) Folded linen, lint, or other materials, making a sort of pad, which surgeons place over those parts of the body on which they wish to make particular pressure, and for this purpose a bandage is usually applied over the compress. Compresses are also frequently applied to prevent the ill effects, which the pressure of hard bodies, or tight bandages, would otherwise occasion.

COMPRESSION OF THE BRAIN. (See *Head, Injuries of*.)

CONCUSSION OF THE BRAIN. (See *Head, Injuries of*.)

CONDUCTOR. (from *conduco*, to guide.) A surgical instrument for directing the knife in certain operations. It is more commonly called a *director*.

CONDYLOMA. (from *κονδυλίς*, a tubercle, or knot.) A small, very hard tumour. The term is generally applied to excrescences of this description about the anus. The practitioner may either destroy them with the lapis infernalis, tie their base with a ligature, so as to kill them, or remove them at once, with a knife: the first is generally the worst; the last the best and most speedy method.

CONIUM MACULATUM. Hemlock.—*Cicuta.* This is a medicine to which my observations in practice incline me to impute considerable efficacy in several surgical diseases. However, there is no doubt that, when it is represented as a certain cure for cancer and scrofula, exaggeration is employed. It is an excellent remedy for irritable painful sores of the scrofulous kind, and it will complete the cure of many ulcers, in which the venereal action has been destroyed by mercury, though the healing does not proceed in a favourable way. Hemlock is likewise beneficial to se-

veral inveterate malignant sores, particularly some, which are every now and then met with upon the tongue. It is an eligible alterative in cases of noli me tangere, porrigo, and various herpetic affections. I have seen several enlargements of the female breast give way to hemlock conjoined with calomel. Some swellings of the testes also yield to the same medicines. Hemlock certainly has not the power of curing cancer; but, its narcotic anodyne qualities tend to lessen the pain of that distemper, so as to render it by no means a contemptible remedy in that intractable kind of case.

Respecting hemlock, Mr. Pearson observes, that the extract and powder may be sometimes given with evidently good effect in spreading irritable sores; whether they are connected with the active stage of the venereal virus, or whether they remain after the completion of the mercurial course; and it would seem, that the benefit conferred by this drug, ought not to be ascribed solely to its anodyne qualities, since the same advantages cannot always be obtained by the liberal exhibition of opium, even where it does not disagree with the stomach. He states that cicuta is almost a specific for the venereal ulcers, which attack the toes at their line of junction with the foot, and which frequently become gangrenous. Also, in spreading sores, which are accompanied with great pain, and no appearance of remarkable debility, hemlock will often do more than bark, vitriol, or cordials. The common mode of exhibiting hemlock is in the form of pills, made of the extractum conii, five grains to each. However, I have always thought three grains sufficient to begin with, the dose being afterwards gradually augmented. It is curious how large a quantity may at last be taken in this manner. Mr. J. Wilson, in his *Pharmacopœia Chirurgica*, informs us of a remarkable case of cancerous ulcer, for which the patient took a hundred and twenty pills, each consisting of five grains of the extractum conii, in twenty-four hours, and this without any benefit being produced, or any inconvenience to the patient.

The stomach being a little disordered, and the head somewhat giddy, is a sign of the dose being sufficiently strong.

"According to some writers, but more particularly Dr. Withering, there are several ways, in which the views of a medical practitioner, in prescribing this remedy, may be frustrated. The plant chosen for preparing the extract may not be the true *conium maculatum*, which is distinguished by red spots along the stalk. It may not be gathered when in perfection, namely, when beginning to flower. The inspissation of the juice may not have been performed in a water-bath, but, for the sake of despatch, over a common fire. The leaves, of which the powder is made, may not have been cautiously dried and preserved in a well stopped bottle; or, if so, may still not have been guarded from the ill effects of exposure to light. Or, lastly, the whole medi-

cine may have suffered from the mere effects of long keeping. From any of these causes, it is evident, the powers of cicuta may have suffered; and it happens, no doubt, very frequently, that the failure of it ought, in fact, to be attributed to one or other of them." (*Pharmacopœia Chirurgica*, published in 1802; p. 174.)

I have sometimes prescribed as an alterative with manifest benefit in several surgical diseases, a pill containing three grains of extractum conii, one of hydrargyri submurias (calomel,) and one of antimonii sulphuretum præcipitatum. (*F. Hoffman, of Hemlock, 8vo. Lond. 1763. A. Störck, Libellus, quo demonstratur cicutam non solum usu interno tutissimè exhiberi, sed et esse simul remedium valde utile, &c.; Editio altera, 8vo. Vindob. 1761. Also Supplementum Necessarium de Cicuta, 8vo. Vindob. 1761. J. Pearson, On various Articles of the Materia Medica, &c. 2d Edit. 8vo. Lond. 1807.*)

CONTUSED WOUNDS. (See *Wounds*.)

CONTUSION. (from *contundo*, to bruise.) A bruise.

Slight bruises seldom meet with much attention; but, when they are severe, very bad consequences may ensue, and these are the more likely to occur, when such cases are not taken proper care of.

In all severe bruises, besides the inflammation which the violence necessarily occasions, there is an instantaneous extravasation, in consequence of the rupture of many of the small vessels of the part. In no other way can we account for those very considerable tumours which often rise immediately after injuries of this nature. The black and blue appearance instantly following many bruises, can only be explained by there being an actual effusion of blood from the small arteries and veins, which have been ruptured. Even largish vessels are frequently burst in this manner, and considerable collections of blood are the consequence. Blows on the head very often cause a large effusion of blood under the scalp. I have seen many ounces thus extravasated.

Besides the rupture of an infinite number of small vessels and extravasation, which attend all bruises in a greater or less degree, the tone of the fibres and vessels, which have suffered contusion, is considerably disordered. Nay, the violence may have been so great, that the parts are from the first deprived of vitality, and must slough.

Parts at some distance from such as are actually struck, may suffer greatly from the violence of the contusion. This effect is what the French have named a *contrecoup*.

The bad consequences of bruises are not invariably proportioned to the force which has operated; much depends on the nature and situation of the part. When a contusion takes place on a bone, which is thinly covered with soft parts, the latter always suffer very severely in consequence of being pressed, at the time of the accident, between two hard bodies. Hence, bruises of the shin so frequently cause sloughing and

troublesome sores. Contusions affecting the large joints, are always serious cases; the inflammation occasioned is generally obstinate, and abscesses and other diseases, which may follow, are proper grounds for serious alarm.

In the treatment of bruises, the practitioner has three indications, which ought successively to claim his attention.

The first is to prevent and diminish inflammation, which, from the violence done, must be expected to arise. The bruised parts should be kept perfectly at rest, and be covered with linen, constantly wet with the liquor plumbi acetatis dilutus. When muscles are bruised, they are to be kept in a relaxed position, and never used.

If the bruise should have been very violent, it will be proper to apply leeches, and this repeatedly, and even in some cases, particularly when the joints are contused, to take blood from the arm. In every instance, the bowels should be kept well open with saline purgatives.

A second object in the cure of contusions, is to promote the absorption of the extravasated fluid by discutient applications.—These may at once be employed in all ordinary contusions, not attended with too much violence; for then nothing is so beneficial as maintaining a continual evaporation from the bruised part, by means of the cold saturnine lotion, and, at the same time, repeatedly applying leeches. In common bruises, however, the *Lotio ammoniæ muriatæ* (see this article.) is an excellent discutient application; but most surgeons are in the habit of ordering liniments for all ordinary contusions, and certainly they do so much good in accelerating the absorption of the extravasated blood, that the practice is highly praiseworthy. The linimentum saponis, or the linimentum camphoræ, are as good as any that can be employed. (See *Linimentum*.)

In many cases, unattended by any threatening appearances of inflammation, but in which there is a good deal of blood and fluid extravasated, bandages act very beneficially, by the remarkable power which they have of exciting the action of the lymphatics, by means of the pressure which they produce.

A third object in the treatment of contusions, is to restore the tone of the parts.—Rubbing the parts with liniments has a good deal of effect in this way. But, notwithstanding such applications, it is often observed, that bruised parts continue for a long while weak, and even swell, and become œdematous, when the patient takes exercise, or allows them to hang down, as their functions in life may require. Pumping cold water two or three times a day, on a part thus circumstanced, is the very best measure which can be adopted. A bandage should also be worn, if the situation of the part will permit. These steps, together with perseverance in the use of liniments, and in exercise gradually increased, will soon bring every thing into its natural state again.

CORNEA TUNICA. (from *cornu*, a horn.)

The anterior transparent convex part of the eye, which in texture is tough like horn. It has a structure peculiar to itself, being composed of a number of concentric cellular lamellæ, in the cells of which is deposited a particular sort of fluid. It is covered externally by a continuation of the conjunctiva, which belongs to the class of mucous membranes; and it is lined by a membrane, the tunica humoris aquei, which seems to belong to the serous class.

FLESHY EXCRESCENCES OF THE CORNEA.

Mr. Wardrop, in his *Essays on the Morbid Anatomy of the Human Eye*, has published an excellent chapter on this subject. Besides pterygia, which are treated of in another part of this dictionary, Mr. Wardrop states that the cornea is subject to two kinds of caruncles, or fleshy excrescences. One appears at birth, or soon after it, and resembles the *nævi materni* so frequent on the skin of various parts of the body. The second is described as having a greater analogy to the fungi, which grow from mucous surfaces, and being in general preceded by ulceration.

Of the congenital excrescence of the cornea, Mr. Wardrop has seen two remarkable instances. The first was in a girl, eight or ten years of age, on whose left eye there was a conical mass, the base of which grew from about two-thirds of the cornea, and a small portion of the adjoining sclerotic coat.

The second example occurred in a patient upwards of fifty years old. The tumour had been observed from birth, was about as large as a horse-bean, and only a small portion of it seemed to grow from the cornea. The other part was situated on the white of the eye, next the temporal angle of the orbit. From the middle of the excrescence, upwards of twelve long firm hairs grew, and hung over the cheek.

Mr. Wardrop acquaints us, that a similar tumour, with two hairs growing out of it, was seen at Lisbon by Dr. Barron, of St. Andrews. Mr. Crampton also mentions, that he once saw a "tuft of very strong hairs proceeding from the sclerotica." (*Essay on the Entropion*, p. 7.) And De Gazezelles met with an instance in which a single hair grew from the cornea. (*Journ. de Médecine*, Tom. 24.) According to Mr. Wardrop, this species of excrescence of the cornea greatly resembles the spots, covered with hair, which are frequent on various parts of the surface of the body.

With regard to the second kind of tumour growing from the cornea, a fungus, proceeding from an ulcer of this part of the eye, is stated to be very uncommon. However, it is said, that, when a portion of the iris protrudes through an ulcer of the cornea, the growth of a large excrescence from the projecting part is not so unusual. Of such a disease, Mr. Wardrop has cited examples from *Maitre Jean's Traité des Maladies des*

yeaux; Voigtel, Beer, and Plaichner. Excrecences, growing from the cornea, are also quoted from the following works; *Handbuch der Pathologischen Anatomie, Von F. G. Voigtel, Halle, 1804. Praktische Beobachtungen über den grauen Star und die Krankheiten der Hornhaut, von Joseph Beer, Wien, 1791. Plaichner's Dissertatio, de Fungo Oculi.* (See Wardrop's *Essays on the Morbid Anatomy of the Human Eye, Vol. 1, chap. 4.*) Others are likewise described by Mery, in *Mém. de l'Acad. des Sciences, 1783*; by Dupré in *Phil. Trans. Vol. 19*; and Home in the same Work, Vol. 81.

The only treatment which excrecences of the cornea admit of, is to remove them with a scalpel and a pair of forceps, or to destroy them with caustic.

ABSCESSSES OF THE CORNEA.

The following description of abscesses of the cornea, is taken from Mr. Wardrop's valuable work on the *Morbid Anatomy of the Eye*.

When the matter is collected between the lamellæ of the cornea, it first appears like a small spot; and, instead of resembling a small speck in colour, it is of the yellow hue of common pus. As the quantity of the matter increases, this spot becomes broader, and it does not alter its situation from the position of the head. If it be situated among the external layers of the cornea, or immediately below the corneal conjunctiva, a tumour is formed anteriorly, and, if touched with the point of a probe, the contained fluid can be felt fluctuating within, or if the eye be looked at sideways, an alteration in the form of the cornea may be readily perceived.

When the matter collects between the interior lamellæ, it does not produce any evident alteration, in the external form of the cornea; but, if it be touched with the point of a probe, a fluctuation can be more or less distinctly perceived, and the spot alters its form, and becomes somewhat broader.

Such collections of matter appear on every part of the cornea. Sometimes they alter their situation by degrees, and sink downwards; and sometimes they change both their situation and form. They very seldom cover more than one-fourth or one-third of the cornea.

When the quantity of matter is small, it is often completely absorbed during the abatement of the inflammatory symptoms, and it generally leaves no vestige behind it. In other cases, the cornea is eroded externally, producing an ulcer, and subsequent opacity. In some few instances, the internal lamellæ of the cornea gives way, and the matter escapes into the anterior chamber. When an artificial opening is made, the matter often does not readily flow out; and it is sometimes so tenacious, and contained in a cavity so irregular, that it neither escapes spontaneously, nor can it be evacuated by art.

It is particularly to the cases, in which

matter collects between the layers of the cornea, that the terms *unguis*, and *onyx*, are applied. (See Wardrop's *Essays on the Morbid Anatomy of the Human Eye, Vol. 1, chap. 6.*) According to a late writer, these words should be restricted to what he names "crescentic interlamellar depositions."—(Travers's *Synopsis of the Diseases of the Eye, p. 115.*) Where the cornea is affected with onyx, this gentleman commends antiphlogistic treatment. (P. 278.) And with respect to a large collection of matter in the cornea, whether the puriform onyx, or central abscess, he observes that it requires "a supporting constitutional treatment, mild cathartics, and the application of blisters;" calomel should be avoided, and the cornea can seldom be punctured to advantage. (P. 280.)

OPACITIES OF THE CORNEA.

Opacity of the cornea is one of the worst consequences of obstinate chronic ophthalmia. The term *opacity* is used, when the loss of transparency extends over the whole, or the greater part of the cornea; while other cases of a more limited kind are named *specks*. The distinction, as Beer observes, is chiefly important in respect to the prognosis. (*Lehre von den Augenkr. B. 2, p. 77.*)

Searpa distinguishes the superficial and recent species of opacity from the *albugo* and *leucoma*, (see *these words*), which are not in general attended with inflammation, assume a clear pearl colour, affect the very substance of the cornea, and form a dense speck upon this coat of the eye. The *nebula*, or slight opacity, here to be treated of, is preceded and accompanied by chronic ophthalmia; it allows the iris and pupil to be discerned through a kind of cloudiness, and consequently does not entirely bereave the patient of vision, but permits him to distinguish objects, as it were, through a mist. The *nebula* is an effect of protracted or ill treated chronic ophthalmia. The veins of the conjunctiva, much relaxed by the long continuance of the inflammation, become preternaturally turgid and prominent; afterwards they begin to appear irregular and knotty, first in their trunks, then in their ramifications, near the union of the cornea with the sclerotica, and lastly, in their most minute ramifications, returning from the delicate layer of the conjunctiva, spread over the cornea. It is only, however, in extreme relaxation of the veins of the conjunctiva, that these very small branches of the cornea become enlarged.

When this happens, some reddish streaks begin to be perceptible, in the interspace of which, very soon afterwards, a thin milky albuminous fluid is effused, which dims the diaphanous state of the cornea. The whitish, delicate, superficial speck, thence resulting, forms precisely what is termed, *nebula*, or the kind of opacity here to be considered. And since this extravasation may happen only at one point of the cornea, or in more places, the opacity may be in one speck, or

in several distinct ones, but which altogether diminish, more or less, the transparency of this membrane.

The cloudiness of the cornea, which sometimes takes place in the inflammatory stage of violent acute ophthalmia, especially differs from the species of opacity expressed by the term *nebula*. The first is a deep extravasation of coagulating lymph in the internal cellular texture of the cornea, or else the opacity proceeds from an abscess between the layers of this membrane about to end in ulceration. On the other hand, the *nebula* forms slowly upon superficies of the cornea, in long protracted chronic ophthalmia; is preceded first by a varicose enlargement of the veins in the conjunctiva, next of those in the delicate lamina of this tunic, continued over the front of the cornea; and finally it is followed by an effusion of albuminous lymph in the texture of this thin layer, expanded over the transparent part of the eye. This effusion never elevates itself in the shape of a pustule. Wherever the cornea is affected with *nebula*, the part of the conjunctiva, corresponding to it, is constantly occupied by a net-work of varicose veins, more knotty and prominent than other vessels of the same description, and though the cornea be clouded at more points than one, there are distinct corresponding fasciculi of varicose veins in the white of the eye. Scarpa injected an eye affected with chronic ophthalmia, and *nebula*, and he found that the wax easily passed, both into the enlarged veins of the conjunctiva, and those of that part of the surface of the cornea, where the opacity existed; the inoculations all round the margin of the cornea were beautifully variegated, without trespassing that line, which bounds the sclerotica, except on that side, where the cornea was affected with the species of opacity.

Mr. Travers does not adopt precisely the same definition of *nebula*, as Scarpa; for, he describes it as a thickening of the conjunctiva, and an effusion of adhesive matter between it and the cornea, or between the lamellæ of the latter, commonly the product of acute strumous ophthalmia. (*Synopsis*, &c. p. 118.)

According to Scarpa, the superficial opacity, which alone he calls *nebula*, demands, from its very origin, active treatment; for, though at first it may only occupy a small portion of the cornea, when left to itself, it advances towards the centre of this membrane, and the ramifications of the dilated veins upon this coat, growing still larger, at length convert the delicate continuation of the conjunctiva upon the surface of the cornea, into a dense opaque membrane, obstructing vision.

The curative indication in this disease is to make the varicose vessels resume their natural diameters, or if that be impracticable, to cut off all communication between the trunk of the most prominent varicose veins of the conjunctiva, and the ramifications coming from the surface of the cornea, the seat of the opacity. The first

mode of treatment is executed by means of topical astringents and corroborants, especially Jacin's ophthalmic ointment, and success attends it, when the opacity is in an early state, and not extensive. But when advanced to the centre of the cornea, the most infallible treatment is the excision of the fasciculus of varicose veins near their ramifications, that is, near the seat of the opacity. By means of this excision, the blood retarded in the dilated veins of the cornea is voided; the varicose veins of the conjunctiva have an opportunity to contract and regain their tone, no longer having blood impelled into them; and the turbid secretion effused in the texture of the layer of the conjunctiva continued over the cornea, or in the cellular substance, connecting these two membranes, becomes absorbed. The celebrity, with which the *nebula* disappears, after this operation, is surprising, commonly in twenty-four hours. The extent, to which the excision of the varicose veins of the conjunctiva must be performed, depends upon the extent of the opacity of the cornea. Thus, should there be only one set of varicose vessels, corresponding to an opacity of moderate extent, it is sufficient to cut a portion of them away. Should there appear several dim specks upon the cornea, with as many distinct sets of varicose vessels, arranged round upon the white of the eye, the surgeon must make a circular incision into the conjunctiva, near the margin of the cornea, by which he will certainly divide every plexus of varicose vessels. But let it be observed, that a simple incision through the varicose vessels is not permanently effectual in destroying all direct communication between the trunks and ramifications of these vessels upon the cornea, after such an incision made, for instance, with a lancet; though it be true that a separation of the mouths of the divided vessels follows in opposite directions, it is no less true, that in the course of a few days after the incision, the mouths of the same vessels approximate each other, and inosculate, so as to resume their former continuity. Hence, to derive from this operation all possible advantage, it is essential to extirpate with the knife a small portion of the varicose plexus, together with the adherent particle of the tunica conjunctiva.

The eyelids are to be separated from the affected eye by a skilful assistant, who is, at the same moment, to support the patient's head upon his breast. The surgeon is then to take hold of the varicose vessels, with a pair of small forceps; near the edge of the cornea, and to lift them a little up, which the lax state of the conjunctiva renders easy; then, with a pair of small curved scissors, he is to cut away the plexus of varicose vessels, together with a small piece of the conjunctiva, making the wound of a semilunar form, and as near as possible to the cornea. If it should be necessary to operate upon more than one plexus of varicose vessels situated at some distance apart, the surgeon must elevate them one after the other with the forceps and remove them. But, when

they are very close together, and occupy every side of the eye, he must make an uninterrupted circular incision in the conjunctiva, guiding it closely to the margin of the cornea all round, so as to divide with the conjunctiva, all the varicose vessels.

This being done, he may allow the cut vessels to bleed freely; even promoting the hemorrhage by fomenting the eyelids, until the blood discontinues to flow. Scarpa then covers the eye with an oval piece of the emplastrum saponis, and a retentive bandage. The eye ought not to be opened till twenty-four hours after the operation, when, usually, the opacity of the cornea will be found completely dispersed; and, during the ensuing days, the patient is to be enjoined to keep the eye shut, and covered with a bit of fine rag. A collyrium of milk and rose-water warm, may be applied two or three times a day. When the inflammation of the conjunctiva happens, about the second or third day after the operation, particularly in cases in which the incision is made all round, while the greater part of the sphere of the eye reddens, a whitish circle, in the place of the incision, forms a line of boundary to the redness which does not extend further upon the cornea. This inflammation of the conjunctiva, with the aid of internal antiphlogistic remedies, and topical emollients, abates in a few days, and then pus is secreted along the track of the incision in the conjunctiva. The wound contracts, and growing smaller and smaller, soon cicatrizes. Bathing the eye with warm milk and rose-water is the only local treatment necessary in this stage of the complaint.

Thus, not only the transparency of the cornea is revived, but also the preternatural laxity of the conjunctiva is diminished, or even removed. When the conjunctiva subsequently appears yellowish and wrinkled, the use of topical astringents and corroborants, and of Janin's ophthalmic ointment, may be highly beneficial, in preventing the recurrence of the varicose state of the vessels. (*Scarpa sulle malattie degli occhi, c. 8.*)

According to the experience of Dr. Vetch, Scarpa's plan of removing the plexus of varicose vessels, together with a portion of the conjunctiva, produces no good effect, "except in cases of great relaxation of the membrane covering the eye." He asserts, that new vessels immediately appear in the room of those removed, and the good derived from the bleeding does not compensate for the irritation produced by the operation. (*A Practical Treatise on the Diseases of the Eye, p. 86.*) However, when it is reflected, that Scarpa advises this practice only for advanced cases, and particularly recommends topical astringents for the more recent stages of the disease, he nearly agrees with Dr. Vetch, as far as this point is concerned. But, Scarpa's account of the disease and its treatment is left imperfect by the omission of any notice of the connexion frequently existing between opacity of the cornea, and a rough scabrous granulated

state of the lining of the eyelids. Yet perhaps, Scarpa was not to be expected to treat of this combination in his chapter on nebula, because his definition of this superficial opacity will not altogether suit the affection of the same membrane, referred to in the following observations. It is remarked by Dr. Vetch, that, after the complete cessation of conjunctival ophthalmia, as far as regards that portion of the membrane, which covers the eye, the villous elongation of the vessels of the lining of the eyelids, instead of recovering their natural state, acquire a further increase of size, so as to produce a rough, scabrous or granulated surface, with a secretion of puriform matter. The irritation of this unequal surface gradually induces an inflammatory state of the sclerotic vessels, and, consequently, a greater flow of blood towards the cornea: the superficial vessels become varicose; the conjunctiva assumes a dusky and loaded appearance; and the cornea becomes opaque, not partially, but throughout the whole extent of its structure. This affection, says Dr. Vetch, is essentially different from those nebulous, or partial opacities, which take place in primary sclerotic inflammation, and which consist in slight extravasations, accompanied by intolerance of light, and in which any affection of the palpebral linings is a secondary, instead of a primary circumstance. The cornea is of the green colour, presented by a broken gun-flint; and while it is sufficiently diaphanous to permit the perception of light, it is yet too opaque to allow the patient to discern external objects, except by their shades. Nor can the colour of the iris, and limits of the pupil be seen. Dr. Vetch also describes the conjunctiva as being sometimes so much relaxed, and its vessels so generally loaded, as to give it a dusky appearance similar to that of the cornea; and, in other instances, without much alteration of its thickness, or transparency, it is said to lose for a considerable extent its close attachment to the subjacent lamina of the cornea. Along with the opaque state of the cornea, there is more generally an enlargement of individual vessels, which penetrate almost to its centre, increase as they come outwards, and terminate in trunks, which run to the duplicature of the conjunctiva. Dr. Vetch represents this disease of the palpebræ as consisting at first in a highly villous state of their membranous lining. This state, if not rectified by proper treatment, gives birth to granulations, which, in time, become more deeply sulcated, hard, or warty, accompanied by an oozing of purulent matter. Dr. Vetch has explained, that the use of the actual cautery, excision, and friction, for the purpose of curing the diseased state of the eyelids, may be traced back to Hippocrates, who prefers escharotics. Dr. Vetch ascribes their first employment in these cases to St. Ives. Mr. Saunders, he observes, took an early and a just view of the relations, existing between the diseased conditions of the palpebral linings, and the opaque state of the cornea; and he

succeeded in establishing the cure of the latter by the removal of the former. In short, Dr. Vetch admits, that, in the case, which more especially formed the claim of Mr. Saunders to the discovery of the nature of the disease, the practice of excision was attended with complete success. Dr. Vetch contends, however, that this method is for the most part inadequate to the cure of the disease; and that there are very few cases, in which the more certain and consistent process of gradually repressing the diseased surface by escharotic substances will not produce a more complete and permanent cure. After giving a fair trial to a great variety of escharotics, made into ointments, and applied to the inside of the upper eyelid, Dr. Vetch found the direct application of the escharotic substances themselves was preferable. When there is too much increased action in the vessels of the sclerotic coat, Dr. Vetch recommends the use of escharotics to be preceded by cupping the temples: or, where there is any risk of a slough, the application of a leech to the inside of the lower eyelid. Whatever will bring on a determination of blood to the head is to be avoided, and a low regimen observed.

The escharotics, preferred by Dr. Vetch, are the sulphate of copper and nitrate of silver, scraped in the form of a pencil, and fixed in a portcrayon. In this way, Dr. Vetch says, they should be applied, not as some have conceived, with the view of producing a slough over the whole surface, but, with great delicacy, and in so many points only, as will produce a gradual change in the condition and disposition of the part. As long as there is any secretion of pus, the above application may be materially assisted by the daily use of the undiluted liquor plumbi acetatis. When the disease resists these remedies, and its surface is hard and warty, Dr. Vetch applies to the everted surface powder of verdigris, or burnt alum, finely levigated; or even lightly touches the diseased surface with the kali purum. In employing these remedies, he enjoins confining their operation to the point of contact, so as to prevent them from hurting the eye. Hence, they are to be applied in very minute quantities with a fine camel's hair pencil, and to be washed off with an elastic gum syringe, before the eyelid is returned. Of the employment of astringent collyria, in conjunction with escharotics, Dr. Vetch disapproves. (See *A Practical Treatise on the Diseases of the Eye*, p. 67, &c.) With respect to the treatment by excision as first practised by Mr. Saunders with scissors, and afterwards by Sir W. Adams with a knife, the principle of cure does not appear to me different from that aimed at with escharotics, unless these latter be supposed not always to destroy, but sometimes to cause an absorption of the fungous granulations. For the purpose of cutting away the redundant diseased membrane, the eyelids should be everted over a probe.

For the form of disease, termed by Mr.

Travers "strumous nebula, with vessels overshooting the cornea," this gentleman recommends ptyalism. He says, that "the hydrargyrus cum creta, or oxy-muriate, in small, but frequent doses, will sometimes succeed better in this case, than the other forms of mercury, and the combination of calomel with antimony, better than that with opium." When the internal exhibition of mercury either disorders the bowels, or has no effect on the constitution, frictions are to be preferred. (*Synopsis of the Diseases of the Eye*, p. 282.) In the particular form of opacity, to which he alludes, he disapproves of dividing the vessels of the conjunctiva, before the inflammation has declined. (P. 285.)

From some observations, published by Mr. Wardrop, it would appear, that certain opacities of the cornea are produced by an increase in the quantity of the contents of the eyeball, and not by the deposition of an albuminous fluid in the texture of the cornea, as takes place in the common speck. He considers this fact proved by cases, in which the cornea regained its transparency the instant the aqueous humour was evacuated. Some cases are detailed by this gentleman, with the view of recommending the practice of puncturing the cornea, and discharging the aqueous humour, for the relief of the kind of opacity to which we have here alluded. (See *Med. Chir. Trans.* Vol. 4, p. 180, &c.)

For other opacities of the cornea, refer to *Albugo*, *Leucoma*, and *Staphyloma*.

ULCERS OF THE CORNEA.

An ulcer is a common consequence of the bursting of a small abscess, which not unfrequently forms beneath the delicate layer of the conjunctiva continued over the cornea, or in the very substance of the cornea itself, after violent ophthalmia. At other times, the ulcer is produced by the contact of corroding matter, or sharp-pointed bodies insinuated into the eyes, such as quicklime, pieces of glass, or iron, thorns, &c. As Dr. Vetch has observed, ulceration of the cornea is a very frequent consequence of purulent ophthalmia. The little abscess of the cornea is attended with the same symptoms, as the severe acute ophthalmia; especially with a troublesome sensation of tension in the eye, eyebrow, and nape of the neck; with ardent heat; copious secretion of tears; aversion to light; intense redness of the conjunctiva, particularly near the point of suppuration. The inflammatory pustule, compared with similar ones, in any other part of the body, is slow in bursting after matter is formed. Scarpa deems it improper, however, to puncture the small abscess; for, though it assumes the appearance of being perfectly matured, the matter contained in it is so tenacious, and adherent to the substance of the cornea, that not a particle issues out of the artificial aperture, and the wound exasperates the disease, increases the opacity of the cornea, and often occasions another small abscess to form in the

vicinity of the first. Indeed, if the observations of Mr. Travers be correct, "the ulcer of the cornea begins, not in abscess, but, in a circumscribed deposit of lymph, or in pure ulcerative absorption without pus." (*Synopsis of the Diseases of the Eye*, p. 106.) And Dr. Vetch takes notice, that the observation, with respect to fluid matter never forming in the cornea, he invariably found true in several cases, where the whole of the eyeball had been destroyed by inflammation. (*Pract. Treatise on the Diseases of the Eye*, p. 52.) This author differs from Scarpa, however, respecting the question of opening pustules, or abscesses of the cornea; for he remarks, that, whenever the matter, or slough is removed, the ulcer, however deep and extensive, will fill up without leucoma being the consequence. By a little address, he says, it may, in most instances, be removed in a mass upon the point of a lancet, or couching needle. (*Op. cit.* p. 50.) This remark applies both to cases where lymph, or tenacious matter more or less protrudes, and to instances, in which it is quite confined between the lamellæ of the cornea. Scarpa thinks that the safest plan is to temporize, until the pustule spontaneously bursts, promoting it by means of frequent fomentations, bathing the eye with warm milk and water, and applying emollient poultices. The spontaneous bursting of the little abscess is usually denoted by a sudden increase of all the symptoms of ophthalmia; particularly by an intolerable burning pain at the point of the cornea, where the abscess first began, greatly increased by motion of the eye, or eyelid. The event is confirmed by ocular inspection, and at the spot where the white pustule existed, a cavity appears, as may best be seen, when the eye is viewed in the profile. Extraneous bodies in the eye, which have simply divided a part of the cornea, or lodged in it, when soon extracted, do not in general cause ulceration, as the injured part heals by the first intention. Those which destroy or burn the surface of this membrane, or which, when lodged, are not soon extracted, excite acute ophthalmia, suppuration at the injured part, and at length ulceration.

As Dr. Vetch has observed, the appearance of ulceration varies according to the degree of apostematation, or tendency towards it, in the surrounding cornea: when this part is clear, the case is doing well, but when opacity comes on, the ulcer is increasing. The soft middle lamina, he says, is destroyed with great rapidity, when the inflammation is violent, but as soon as the ulcer reaches the internal coat, its progress often proceeds no further. (*Practical Treatise on Diseases of the Eye*, p. 52.)

The ulcer of the cornea, as Scarpa remarks, has this in common with all solutions of continuity in the skin, where this is delicate, tense, and endowed with exquisite sensibility, that, at its first appearance, it is of a pale ash-colour; has its edges high and irregular; creates sharp pain; discharges, instead of pus, an acrid serum, and tends to

spread widely and deeply. Such is the precise character of ulcers upon the cornea, and such is the nature of those upon the nipple of the mamma; the glans penis; lips; apex of the tongue; the tarsi; the entrance of the meatus auditorius externus; nostrils; &c. Ulcers of this description, neglected, or ill treated, speedily enlarge, make their way deeply, and destroy the parts in which they are situated. If they spread superficially upon the cornea, the transparency of this membrane is destroyed; if they proceed deeply, and penetrate the anterior chamber of the aqueous humour, this fluid escapes, and a fistula of the cornea may ensue; and if it should form a larger opening in it, besides the exit of the aqueous humour, it occasions another more grievous malady than the ulcer itself, namely, a prolapsus of a portion of the iris; an escape of the crystalline lens and vitreous humour; in short, a total destruction of the whole organ of sight. It is therefore of the highest importance, as soon as an ulcer appears upon the cornea, to impede its growing larger, as much as the nature of it will permit; the morbid process should be converted into a healing one, and the surgeon must exert his skill with more attention, the more extensive and deep the ulceration has proceeded. According to Scarpa, the cicatrix of a larger ulcer impairs the texture of the cornea so much, that the injury is irreparable. Yet, Dr. Vetch assures us, that when a slough covers an ulcer of considerable extent, and is taken off with great caution, so as not to wound the inner tunic of the cornea; or when it cannot be removed, if it be slightly scarified, and divided; the cornea may recover its transparency after two-thirds of it have been in this state. (*Pract. Treatise on the Diseases of the Eye*, p. 51.)

They who inculcate, that no external application can be adopted with benefit, for the cure of this disease, before the acute ophthalmia has been subdued, or, at least, diminished, are, in Scarpa's opinion, deceived. Experience teaches, that local remedies ought, in the very first instance, to be applied to the ulcer, such as are appropriate to lessen the increased morbid irritability, and stop the destructive process going on; afterwards such means should be taken, as will cure the ophthalmia, if it does not subside gradually, as the ulcer heals. It is a fact, confirmed by repeated observation, that it is the ulcer which keeps up the ophthalmia, not the ophthalmia the ulcer. The case, however, is to be excepted, in which the ulcer makes its appearance in the height of a severe ophthalmia. Here the first indication is to abate inflammation, before attempting to heal the sore.

It is true, that when the little abscess of the cornea breaks, the symptoms of acute ophthalmia are aggravated; the redness of the conjunctiva is increased, as well as the turgid state of its vessels; but it is equally certain, that it happens from no other cause, than an increased inflammation in the part, in consequence of the augmented sensibility

in the ulcerated spot of the cornea. As soon as this increase of sensibility in the ulcer of the cornea ceases, or abates in violence, the ophthalmalmy retreats with equal speed, and finally, when the ulcer heals, the inflammation disappears gradually, or, at most, requires only the use of an astringent, and corroborant collyrium, for a few days. Analogous examples every day occur in practice, in ulcers of other parts, besides the cornea; particularly in little foul ulcers on the inside of the lips, on the apex of the tongue, on the nipples, on the glans penis, which, as was described above, at their first appearance, assume an ash-coloured surface, excite inflammation of the part in which they are seated, and cause a very troublesome itching and ardent heat in the part affected. To subdue this inflammation, we do nothing more, and the vulgar do the same, than repel the excessive irritability in these ulcers, and convert the ulcerative process into cicatrization: this done, the surrounding inflammation immediately disappears of itself.

Such speedy and good effects may be obtained by caustic. It immediately destroys the naked extremities of the nerves in the ulcerated part, and soon removes the diseased irritability in the part affected; it converts the ash-coloured surface of the ulcer, and the serous discharge upon it, into an eschar and scab, which, as a kind of epidermis, moderates the contact of the neighbouring parts upon the ulcer, and at length converts the process of ulceration into that of granulation and cicatrization.

For cauterizing the ulcer of the cornea, the caustic, to which Scarpa gives the preference, is the *argentum nitratum*. It must be scraped to a point like a crayon pencil, and the eyelids being opened perfectly, and the upper eyelid suspended, by means of Pellier's elevator, the ulcer of the cornea is to be touched with the apex sufficiently to form an eschar. Should any of the caustic dissolve in the tears, the eye must be copiously bathed with warm milk. At the instant the caustic is applied, the patient complains of a most acute pain; but this aggravation is amply compensated, by the ease experienced a few minutes after the operation; the burning heat in the eye ceases, as it were by a charm; the eye and eyelids become capable of motion without pain; the flux of tears and the turgidity of the vessels of the conjunctiva decrease; the patient can bear a moderate light, and enjoys repose. These advantages last while the eschar adheres to the cornea.

On the separation of the eschar, sometimes at the end of two, three, or four days after the application of the caustic, the primary symptoms of the disease recur, especially the smarting and burning pain at the ulcerated part of the cornea; the effusion of tears; the restraint in moving the eye and eyelids; and the aversion to light; but all these inconveniences are less in degree than before. At their recurrence, the surgeon, without delay, must renew the application of the *argentum nitratum*, making a

good eschar, as at first, upon the whole surface of the ulcer, which will, as before, be followed by perfect ease in the eye. The application of the caustic is, if required, to be repeated a third time, that is, if upon the separation of the eschar, the extreme irritability in the ulcer is not exhausted, and its progressive mischief checked. When the case goes on favourably, it is a constant phenomenon in the cure of this disease, that, at every separation of the eschar, the diseased sensibility of the eye is decreased; the ulcer also, abandoning its pale ash-colour, assumes a delicate fleshy tint, a certain sign that the destructive process which prevailed is turned into a healing one. The turgid state of the vessels of the conjunctiva, and the degree of ophthalmalmy, disappear, in proportion as the ulcer draws near to a cure. At this epoch, when the formation of granulations has begun, the surgeon would act very wrongly, were he to continue the use of the *argentum nitratum*; it would now reproduce pain, effusion of tears, and inflammation in the eye; and the ulcer would take on that foul ash-coloured aspect, with swelled and irregular edges, which it had in the beginning. Platner has noticed this fact. *Necesse est, ut hoc temperatâ manu, nec crebrius fiat, ne nova inflammatio, novaque lachryma hic acrioribus concitetur. Inst. Chirurg. § 314.* As soon as ease is felt in the eye, and granulations begin to rise, whether after the first, second, or third application of the caustic, the surgeon must refrain from the use of every strong caustic, and use only the following collyrium. *R. Zinci Sulphatis gr. iv. Aq. Rosæ ʒiv. mucil. Sem. Cydon. mali ʒss M.* This to be used every two hours, the eye, in the intervals, being defended from the air and light, by means of a slight compress, and retentive bandage. When, besides the ulcer of the cornea, a slight relaxation of the conjunctiva remains, Janin's ointment, towards the end of the treatment, introduced between the eye and eyelids, morning and evening, proves serviceable. It must be adapted in strength and quantity to the particular sensibility of the patient.

To cure those superficial excoriations of the cornea, which make no excavation in the substance of this membrane, and which, in reality, are only a detachment of the cuticle, covering the layer of the conjunctiva continued over the cornea, the use of caustic is not requisite. The same collyrium, combined with mucilage, is sufficient. The symptoms which accompany such slight excoriations, or detachments of the cuticle, are unimportant, and when the patient takes care to bathe his eye, every two or three hours, with the solution of sulphate of zinc, and to avoid too much light, and exposure to the air, they soon get well.

According to Dr. Vetch, when the ulcerative process is likely to destroy the membrane, which lines the cornea, it can only be checked by measures, calculated to subdue the inflammation, upon which it depends. "As long, therefore, as there is an appear-

ance of activity in the disease, or recurrence of pain, local blood-letting by cupping, or leeches, must be steadily adhered to. The indication of the ulcer healing is easily seen in the diminished activity of the inflammation, relief from pain, and the clean aspect of the ulcerated part. The injection of vegetable, tepid astringent infusions may be used, or milk and water only. When called upon in extreme cases, where the immediate perforation of the inner membrane is threatened, we may, with great propriety, resort to the operation of puncturing the cornea at a place as remote as possible from the ulcer. Next in importance to a diminution of the action, on which the ulcer depends, is the removal by scarification of any slough thrown out from its surface, or imbedded in the adjoining part of the cornea. Sometimes, but always subordinate to these indications, we may add some topical applications to the ulcer; a solution of nitrate of silver, the infusion of tobacco, or calomel, in powder, applied with a camel's hair pencil." (*Practical Treatise on Diseases of the Eye*, p. 57.) In incipient protrusions of the inner membrane of the cornea, this author decidedly condemns the use of the argenteum nitratum in the free manner proposed by Scarpa; observing, that, "if the caustic touches by accident the edge of the ulcer, or any part but the apex of the projecting vesicle, it will often produce much mischief."

Thus far of ulcers of the cornea, and the best mode of curing them in ordinary cases. However, sometimes, says Scarpa, in consequence of ill-treatment, the ulcer, already very extensive, assumes the form of a fungous excrescence upon the cornea, appearing to derive its nourishment from a band of blood-vessels of the conjunctiva; and, on this account, it occasions, not unfrequently, a serious mistake in being taken for a real pterygium. Left to itself, or treated with slight astringents, it produces, in general, a loss of the whole eye. It requires the speedy adoption of some active and efficacious plan, to destroy all the fungus upon the cornea, to annihilate the vessels of the conjunctiva tending to it, and to impede the progress of ulceration. This consists first in cutting away the fungus, with a pair of small scissors, to a level with the cornea, continuing the incision far enough upon the conjunctiva, to remove, with the excrescence, that string of blood-vessels, from which it seems to derive its supply. Having effected this, and allowed the blood to flow freely, Scarpa applies the argenteum nitratum to all the space of the cornea, which appears to have been the seat of the fungus, so as to make a complete eschar; and if, upon its separation, the whole morbid surface should not be destroyed, he repeats the caustic until the ulcerative process changes into a healing one. To execute commodiously such a full application of the caustic, it is not in general enough to have the upper eyelid raised by an assistant, and the lower one depressed; it is also further

requisite, that the operator, by means of a spatula, introduced between the upper eyelid and the eyeball, should hold the same elevated with his own left-hand, while, with the right, he applies the caustic, so as to form a strong deep eschar.

The action of the caustic cannot always be calculated with precision, and therefore a portion of the whole thickness of the cornea may be destroyed with the fungus, which never fails to be followed by a prolapsus of part of the iris, through the aperture made in the cornea. This accident may seem grievous, yet it is not irreparable, as will be shown in the article *Iris, Prolapsus of*; and when the surgeon can produce a firm cicatrix at the point, where the excrescence was situated, which prevents a reproduction of the fungus, and a total destruction of the eye, he has fulfilled the indications required. (*Scarpa sulle Malattie degli Occhi*.)

In a late publication, two cases of ulcer of the cornea are recorded, which were benefited by Mr. Wardrop's operation of puncturing the cornea and discharging the aqueous humour. In the first example, there was an ulcer on the central part of the cornea, and a cluster of blood-vessels passing towards it. The whole eyeball was also much inflamed. The puncture was made at the place where the vessels passed. The patient's severe headach was relieved, and under the use of fomentations, and the vinous tincture of opium, all the other symptoms rapidly subsided. In the second case, there were two or three erosions, with a good deal of muddiness of the cornea, headach, &c. The obscurity of this membrane instantly disappeared, and the headach subsided, upon the aqueous humour being discharged. With the help of bleeding and fomentations, the symptoms abated, the ulcer healed in a few days, and the eye recovered. (*See Med. Chir. Trans. Vol. 4, p. 186—187*.)

In superficial ulcers of the cornea, attended with much inflammation of the conjunctiva, Mr. Travers recommends opium, combined so as to operate upon the skin, and keeping the bowels well open. Here he differs from Scarpa, in specifying the use of the nitrate of silver, as the best local treatment. Warm fomentations, he says, afford temporary relief, and where the inflammation of the sclerotica is intense, he advises the exhibition of mercury. (*Synopsis of the Diseases of the Eye*, p. 278.)

With regard to the treatment of indolent, and deep sloughing ulcers of the cornea, Mr. Travers praises, in addition to the employment of the nitrate of silver, the occasional use of leeches, and the administration of tonics and sedatives.

The same author has also noticed chronic interstitial ulcers, where the cornea is transparent, "but indented, like a bonce, when struck upon a marble hearth, or pitted, according as the ulcers are diffused, or circumscribed." These are said to succeed acute inflammation, when large quantities of blood

have been lost, and to occur frequently in children imperfectly nourished, or in adults, who are very debilitated. With the aid of good diet, tonics, and moderate topical stimulants, like the *vinum opii*, or the zinc collyrium, they become hazy, which denotes the commencement of the adhesive inflammation. (*Op. cit. p. 117.*)

OSSIFICATION OF THE CORNEA.

Mr. Wardrop has seen only one instance of ossification of the cornea; and, in that case, the whole eye was changed in its form, and the cornea had become opaque. On macerating the latter part, a piece of bone, weighing two grains, oval-shaped, hard, and with a smooth surface, was found between its lamellæ. A piece of bone was also found between the choroid coat and retina.

The same gentleman informs us, that Walter had, in his museum, a piece of cornea, taken from a man sixty years of age, containing a bony mass, which was three lines long, two broad, and weighed two grains.

In Mr. Wardrop's publication, there is also recorded a curious case, in which a portion of bone was formed, either in the substance of the cornea, or immediately behind it, and which was extracted from the eye by Mr. Anderson, surgeon at Inverary. The patient was a woman thirty-one years of age, and the formation of the bony substance, which was about half as large as a sixpence, is said to have been occasioned by a fall against the root of a tree, fifteen years before the operation, by which accident the eye was struck, though not cut. (See *Wardrop's Essays on the Morbid Anatomy of the Human Eye*, Vol. 1, chap. 10.)

ALTERATION IN THE FORM OF THE CORNEA.

This is the last subject which I shall take notice of in the present article. It is well known, that the convexity of the cornea varies in different persons, and in the same individual at different periods of life, this part of the eye being naturally most convex in young subjects. It appears, also, from the experiments of the late Mr. Ramsden, and those of Sir E. Home, that the sphericity of the cornea is altered according to the distance at which objects are viewed.

Sometimes the cornea projects, or collapses so considerably, without its transparency being affected, that sight is much impaired, or quite destroyed. The first case has been called by some authors, the *Staphyloma pellucidum*; the second *Rhytidosis*. Leveillé, the French translator of Scarpa's book on the diseases of the eye, has described a case, in which the cornea of both eyes became of a conical form. Mr. Wardrop met with two examples of a similar disease; but only one eye was affected in each of them. In both cases, the conical figure of the cornea was very remarkable, and the apex in the cone was in the centre of the cornea. When the eye was viewed

laterally, the apex resembled a piece of solid crystal, and when looked at directly opposite, it had a transparent sparkling appearance, which prevented the pupil and iris from being distinctly seen.

One of these cases occurred in a lady upwards of thirty years of age, and the changes produced in her vision were very remarkable. At the distance of an inch, or an inch and a half, she could plainly distinguish small objects, when held towards the temporal angle of the eye, although it required considerable exertion; but the sphere of vision was very limited.

On looking through a small hole in a card, she could distinguish objects held very close to the eye, and could even read a book.

At any distance greater than two inches, vision was very indistinct; and, at a few feet, she could neither judge of the distance, nor the form of the object.

When she looked at a distant luminous body, such as a candle, it was multiplied five or six times, and all the images were more or less indistinct. She could never find any glass sufficiently concave to assist her vision. She did not remark this complaint in her eye, until she was about sixteen years of age, and she does not think it has undergone any change since that time.

In Mr. Wardrop's publication may be read a letter from Dr. Brewster, giving an explanation of the phenomena of the foregoing case.

It appears, that Mr. Phipps has had opportunities of watching the progress of several cases, in which the cornea had become conical, and that he never saw the disease in persons under the age of fourteen or sixteen. The same gentleman also observes, that when the cone is once complete, the disease seldom makes any further progress, except that the apex sometimes becomes opaque.

Burgman saw a remarkable case, where the cornea of both the eyes of a person, who had been hanged, were so prodigiously extended, that they reached down to the mouth, like two horns. (*Haller, Disputationes Chirurg. Tom. 2.*) The chapter by Mr. Wardrop on the preceding subject will be found highly interesting to such as are desirous of further information concerning this curious disease of the eye. (See *Wardrop's Essays on the Morbid Anatomy of the Eye*, Vol. 1, chap. 13.) For information, relative to diseases of the cornea, see *M. Geiger, De Fistula Corneæ*, Tub. 1742. *C. F. Griffheil, De Ulceribus Corneæ*, Tub. 1744. *J. W. Baur, De Maculis Corneæ*, &c. Tub. 1743. *G. H. Volger, De Maculis Corneæ*, 4to. Gott. 1778. *A. G. Richter, Anfangsgr. der Wundarzn. B. 3, Kap. 4*, 8vo. Gott. 1795. *Ant. Scarpa, Trattato delle Malattie degli occhi*, 2 Ed. 8vo. Pavia, 1816, chap. 8, 10. *J. Beer, Praktische Beobacht. über den grauen Staar, und die Krankheiten, Der Hornhaut*, Wien. 1799, und *Lehre von den Augenkr.* 2 B. Wien. 1817. *M. J. Chelius, Ueber die durchsichtige Hornhaut des Auges*,

ihre Function, und ihre Krankhaften Veränderungen. 8vo. Karlsruhe, 1818. A. Clemens, *Diss. sistens Tunica Corneæ et Humoris Aquei Monographiam Physiologico-pathologicam*, 4to. Gott, 1816. J. Wardrop's *Essays on the Morbid Anatomy of the Human Eye*, Vol. 1, 8vo. Edit. 1808. B. Travers, *Synopsis of the Diseases of the Eye*, 8vo. Lond. 1820. J. Velch, *a Practical Treatise on the Diseases of the Eye*, 8vo. Lond. 1820: The sections of this work on opaque cornea, and ulceration of the cornea, are highly interesting.

CORNS. (*Clavi, Spinæ Pedum, Calli, Condylomata, &c.*) A corn, technically called *clavus*, from its fancied resemblance to the head of a nail, is a brawn-like hardness of the skin, with a kind of root sometimes extending deeply into the subjacent cellular substance. When this is the case, the indurated part is fixed; but while the hardness is more superficial, it is quite moveable. Some corns rise up above the level of the skin, in the manner of a flat wart. They are hard, dry, and insensible, just like the thickened cuticle, which forms on the soles of the feet, or on the hands of labouring people.

Corns are entirely owing to repeated and long-continued pressure. Hence, they are most frequently in such situations as are most exposed to pressure, and where the skin is near bones, as on the toes, soles of the feet, &c. However, corns have occasionally been seen over the crista of the ilium, from the pressure of stays, and even on the ears, from the pressure of heavy ear-rings.

Corns of the feet are usually owing to tight shoes, and, consequently, they are more common in the higher classes, and in women, than other subjects. In females, indeed, the ridiculous fashion of wearing high-heeled shoes, was very conducive to this affliction; for, certainly, it merits the appellation. In shoes thus made, the whole weight of the body falls principally on the toes, which become quite wedged, and dreadfully compressed in the end of the shoe.

Though some persons, who have corns, suffer very little, others occasionally endure such torture from them, that they are quite incapable of standing or walking. Doubtless the great pain proceeds from the irritation of the hard corn on the tender cutis beneath, which is frequently very much inflamed, in consequence of the pressure. It is observed, that every thing which accelerates the motion of the blood, which heats the feet, which increases the pressure of the corn on the subjacent parts, or the determination of blood to the feet, or which promotes its accumulation in them, exasperates the pain. Hence, the bad effects of warm stockings, tight shoes, exercise, long standing, drinking, &c. The pain in warm weather is always much more annoying, than in winter.

If a person merely seeks temporary relief, it may be obtained by pulling off his tight shoes, sitting down, placing his feet in a horizontal posture, and becoming a little cool; the prominent portion of the corn

should be cut off, as far as it can be done, without exciting pain, or bleeding, and the feet should be bathed in warm water.

The radical cure essentially requires the avoidance of all the above causes, and, particularly, of much walking, or standing. Wide, soft shoes, should be worn. Such means are not only requisite for a radical cure, but they alone very often effect it. How many women become spontaneously free from corns in childbed, and other confinements! Though the radical cure is so easy, few obtain it, because their perseverance ceases as soon as they experience the wished-for relief.

When business, or other circumstances, prevent the patient from adopting this plan, and oblige him to walk or stand a good deal, still, it is possible to remove all pressure from the corn. For this purpose, from eight to twelve pieces of linen, smeared with an emollient ointment, and having an aperture cut in the middle, exactly adapted to the size of the corn, are to be laid over each other, and so applied to the foot, that the corn is to lie in the opening, in such a manner that it cannot be touched by the shoe, or stocking. When the plaster has been applied some weeks, the corn commonly disappears, without any other means. Should the corn be in the sole of the foot, it is only necessary to put in the shoe a felt-sole, wherein a hole has been cut, corresponding to the situation, size, and figure, of the induration.

A corn may also be certainly, permanently, and speedily eradicated, by the following method, especially when the plaster, and felt-sole with a hole in it, are employed at the same time. The corn is to be rubbed twice a day with an emollient ointment, such as that of marshmallows, or with the volatile liniment, which is still better; and, in the interim, is to be covered with a softening plaster. Every morning and evening, the foot is to be put for half an hour in warm water, and, whilst there, the corn is to be well rubbed with soap. Afterward, all the soft, white, pulpy outside of the corn, is to be scraped off with a blunt knife; but, the scraping is to be left off, the moment the patient begins to complain of pain from it. The same treatment is to be persisted in, without interruption, until the corn is totally extirpated, which is generally effected in eight or twelve days. If left off sooner, the corn grows again.

A multitude of other remedies for curing corns are recommended. They all possess, more or less, an emollient and discutient property. The principal are green wax, soap, mercurial, and hemlock plasters, a piece of green oil-skin, &c. They are to be applied to the corn, and renewed as often as necessary. An infallible composition consists of two ounces of gum ammoniacum, the same quantity of yellow wax, and six drams of verdigris. In a fortnight, if the corn yet remain, a fresh plaster is to be applied.

It is frequently difficult, and hazardous to

cut out a corn. The whole must be completely taken away, or else it grows again; and the more frequently it is partially cut away, the quicker is its growth rendered. When the skin is moveable, and, consequently, the corn not adherent to the subjacent parts, its excision may be performed with facility and safety, but not without pain. But, in the opposite case, either leaving a piece of the corn behind, or wounding the parts beneath, can seldom be avoided. The latter circumstance may excite serious mischief.

A person, entirely cured of corns, is sure to be affected with them again, unless the above-mentioned causes be carefully avoided. Some subjects are, indeed, particularly disposed to have the complaint. There are persons, who for life wear tight shoes, and take no care of their feet, and yet are never incommoded with corns. On the contrary, others are constantly troubled with them, though they pay attention to themselves. Many are for a time vexed with corns, and then become quite free from them, though they continue to wear the same kind of shoes and stockings.

Mr. Wardrop recommends cutting, or tearing away as much of the corn as can be done with safety; then keeping the toe for some time in warm water; and, after the adjacent skin has been well dried, rubbing the exposed surface of the corn with the argenticum nitratum, or wetting it, by the means of a camel-hair pencil, with a solution of the oxy-muriate of mercury in spirit of wine. Either of these applications, two or three times repeated, he says, will mostly effect a cure. (See *Med. Chir. Trans. Vol. 5, p. 140.*) However, the use of caustic for the cure of corns is not a new proposal. (See *Callisen's Syst. Chir. Hodiernæ, Part. 2, 200.*)

The above account is chiefly taken from *Richter's Anfangsgrunde der Wundarzneykunst, B. 1.*

COUCHING. The depression of the cataract, or the introducing of an instrument into the eye, for the purpose of pressing the opaque crystalline lens downward, out of the axis of sight. (See *Cataract.*)

COUVRE CHEF. The name of a bandage. (See *Bandage.*)

CRANIUM. For an account of its fractures, see *Head, Injuries of.*

CREMOR LITHARGYRI ACETATI. R. Cremoris lactis ʒj. Liq. Plumbi. acet.

ʒj. M. Employed by Kirkland in ophthalmies, and other inflammations.

CREPITATION. The crackling noise made in cases of emphysema, when the air is passing from one part of the cellular membrane into another.

CREPITUS. (from *crepo*, to make a noise.) This term is applied by surgeons to the grating sensation, occasioned by the ends of a fracture, when they are moved, and rubbed against each other. A crepitus is one of the most positive symptoms of the existence of such an accident.

* **CUBEBAE** (*Cubabah*, Arab.) *Piper caudatum*. *Cumamus*. *Cubebis*. The dried berries of the *Piper Cubea* of Linnæus:—*foliis oblique ovatis, seu oblongis venosis acutis, spica solitaria pedunculata oppositifolia fructibus pedicellatis*. They are of an ash brown colour, generally wrinkled, and resembling pepper, but furnished each with a slender stalk. They are a warm spice, of a pleasant smell, and moderately pungent taste, imported from Java; and may be exhibited in all cases where warm spicy medicines are indicated. Great encomium has been passed upon this article as a remedy in gonorrhœa, and is considered under that head in the Appendix.

CUPPING. (See *Bleeding.*)

CUPRI SULPHAS. (*Sulphate of Copper.*) Is an escharotic, and an ingredient in several astringent fluid applications, lotions for ulcers, collyria for the eyes, and injections for the urethra.

CURETTE. (French.) An instrument, shaped like a minute spoon, or scoop, invented by Daviel, and used in the extraction of the cataract, for taking away any opaque matter, which may remain behind the pupil, immediately after the crystalline has been taken out.

CURVATURE OF THE SPINE. (See *Vertebræ, Disease of.*)

CYSTITOME. (from *κυστις*, and *τομή*, to cut.) An instrument made on the same principle as the pharyngotomus, and invented by M. de la Faye, for opening the capsule of the crystalline lens.

CYSTOCELE. (from *κυστις*, the bladder, and *κῆλη*, a tumour.) A hernia, formed by a protrusion of the bladder. (See *Hernia.*)

CYSTOTOMIA. (from *κυστις*, the bladder, and *τομή*, to cut.) Making an opening into the bladder for the extraction of a stone or calculus. (See *Lithotomy.*)

D.

DACRYOMA. (from *δακρυον*, to weep.) An impervious state of one, or both the puncta lachrymalia, preventing the tears from passing into the lachrymal sac.

DAUCUS. The carrot, when boiled, and beaten to a pulp, is used in surgery as a poultice, which is often applied to malignant

and phagedenic ulcers. (See *Cataplasma Dauci.*)

DECOCTUM CHAMÆMELI. R. Florum Chamæmeli ʒss. Aquæ Distillatæ lbj. Boil ten minutes, and strain the liquor. A common decoction for fomentations. (See *Fomentum.*)

DECOCTUM DULCAMARÆ. R. Dul-

camaræ Caulis Concisæ unciam, Aquæ Octarium cum Semisse. Decoque ad octarium, et coia.

The decoction of bittersweet, or woody nightshade, is recommended for some cutaneous diseases, proceeding from scrofula, lepra, and lues venerea. The dose is one or two table spoonfuls, three times a day. An aromatic tincture should be added.

DECOCTUM HELLEBORI ALBI.—(Now the *Decoctum Veratri*.) R. Pulveris Radicis Hellebori Albi ℥j. Aquæ Distillatæ lbij. Spiritus Vinosi Rectificati ℥ij. Boil the water and powder, till only one half the fluid remains, and when cold, add the spirit.

This is used as a lotion for curing psora, porrigo, and some herpetic affections.

DECOCTUM LOBELIÆ. (*Blue Cardinal Flower of Virginia*.) R. Radicis Lobeliæ Syphiliticæ Siccæ Manip.j. Aquæ Distillatæ lb. xii. This is to be boiled till only four quarts remain. The lobelia once gained reputation as an antivenereal, though little reliance is now put in it. The patient is at first to take half a pint twice, and afterwards four times a day. It operates, however, as a purgative, and the doses must be regulated according as the bowels appear to bear them.

DECOCTUM MEZEREI. R. Corticis Radicis Mezerei Recentis ℥ij. Radicis Glycyrrhizæ Contusæ ℥j. Aquæ Distillatæ lbij. Boil the mezereon in the water, till only two pints remain; and, when the boiling is nearly finished, add the liquorice root.

The decoction of mezereon has been much prescribed for venereal nodes and nocturnal pains in the bones, in doses of from four to eight ounces, three times a day.

DECOCTUM PAPAVERIS. R. Papaveris Somniferi Capsularum Concisarum ℥iv. Aquæ lbiv. Boil for a quarter of an hour, and strain. In cases attended with great pain and inflammation, this decoction is used as a fomenting fluid.

DECOCTUM QUERCUS. R. Quercus Corticis ℥j. Aqua lbij. Boil down to a pint, and strain the fluid.

This decoction forms a very astringent injection, which is sometimes used for stopping gleans from the vagina. It also makes a lotion, which is of considerable use in cases of prolapsus ani. It may be applied to some slight rheumatic white swellings, which it will sometimes cure, particularly, when a little alum is put into it.

DECOCTUM SARSAPARILLÆ. R. Sarsaparilla Radicis Concisæ ℥iv. Aquæ Ferventis, lbiv. The sarsaparilla is to be macerated for four hours, near the fire, in a vessel lightly closed. The root is then to be taken out, bruised, and put into the fluid again. The maceration is to be continued two hours longer, after which the liquor is to be boiled till only two pints remain. Lastly, it is to be strained.

DECOCTUM SARSAPARILLÆ COMPOSITUM. R. Decocti Sarsaparillæ ferventis lbiv. Sassafras Radicis Concisæ, Guaiaci Ligni Rasi, Glycyrrhizæ Radicis

Contusæ, Singulorum ℥j. Mezerei Radicis Corticis ℥ij. These are to be boiled together for a quarter of an hour, and then strained.

This, and the preceding decoction of sarsaparilla, are much prescribed by surgeons in cases of venereal nodes and pains; but, while some surgeons hold them in high repute, in such cases, others entertain an opposite opinion of them. They are also commonly given in several cutaneous diseases, and in scrofula.

The simple decoction is frequently directed for the restoration of the constitution after a course of mercury, sometimes mixed with an equal quantity of milk.

The common dose of both the decoctions is from four to eight ounces, three times a day.

The compound one possesses similar qualities to those of the famous Lisbon diet drink, for which it is now generally prescribed.

DECOCTUM ULMI. R. Ulmi Corticis Recentis Contus. ℥iv. Aquæ lbiv. Boil to two pints, and then strain the liquor.

The decoction of elm bark is often prescribed in cutaneous diseases. Its operation is frequently promoted by giving with it the hydrargyri submuriæ.

DECOCTUM VERATRI. (See *Decoctum Hellebori Albi*.)

DEPRESSION OF THE SKULL. (See *Head, Injuries of*.)

DEPRESSION OF THE CATARACT. (See *Cataract*.)

DETERMINATION. When the blood flows into a part more rapidly and copiously than is natural, it is said, in the language of surgery, that there is a determination of blood to it.

DIÆRESIS. (from διαίρεσις, to divide.) A division of substance; a solution of continuity. This was formerly a sort of generic term, applied to every part of surgery, by which the continuity of parts was divided.

DIGESTION. (from διγίρω, to dissolve.) By the digestion of a wound, or ulcer, the old surgeons meant bringing it into a state, in which it formed healthy pus.

DIGESTIVES. Applications which promote this object.

DIORTHROSIS. (from διορθωσις, to direct.) One of the ancient divisions of surgery: it signifies the restoration of parts to their proper situations.

DIPLOPIA. (from διπλως, double, and ὁψ, the eye, or ὀφθαλμος, to see.) *Visus duplicatus*. This is one of the most unusual diseases of the eyes, and it is of two kinds. For instance, the patient either sees an object double, treble, &c. only when he is looking at it with both his eyes, and no sooner is one eye shut, than the object is seen single and right; or else, he sees every object double, whether he surveys it with one, or both his eyes. The disorder is observed to affect persons in different degrees. Patients seldom see the two appearances, which objects present with equal distinctness; but generally, discern one much more plainly and perfectly, than the other. The first distinct shape, which

strikes the eye, is commonly that of the real object, while the second is indistinct, false, and visionary. Therefore, patients labouring under this affection, seldom make a mistake, but almost always know which is the true and real object. However, there are cases in which the patient sees with equal clearness, the two appearances which things assume, so that he is incapable of distinguishing the real object from what is false and only imaginary.

The disorder is sometimes transitory and of short duration, and may be brought on in a healthy eye by some accidental cause, generally an irritation affecting the organ. Sometimes, the complaint is continual; sometimes, the complaint is periodical. In particular instances, the patient only sees objects double, when he has been straining his sight for a considerable time, as for example, when he has been reading a small print for a long while by candlelight. In this case, the disorder becomes lessened by shutting the eyes for a few moments. There are also instances, in which the objects only have a double appearance at a particular distance, and not, either when they are nearer or further off. Sometimes the patient sees objects, double only upon one side, as, for example, when he turns his eyes to the right hand, while nothing of this sort is experienced in looking in any other direction. In certain cases, objects appear double, in whatever way the eyes are turned and directed.

The causes of double vision may be divided into four classes. Namely, the object which the patient looks at, may be represented double upon the retina, which is the effect of the first class of causes. Or, the object may be depicted in one eye differently from what it is in the other, in regard to size, position, distance, clearness, &c.; this is the effect of the second class of causes. Or, the object may appear to one eye to be in a different place from that which it seems to the other to occupy: the effect of the third class of causes. Or, lastly, the sensibility of the optic nerves is defective, so that the image of an object, though it may appear single to one eye as well as the other, yet in one identical situation will seem double to both of them. When the complaint originates from causes of the first and fourth class, the patient sees things double, whether he is using only one, or both eyes; but, when it proceeds from the second and third class of causes, the patient sees objects double only when he is looking at them with both eyes, and, no sooner does he shut one, than objects put on their natural, single appearance.

The following are the chief causes of the first class of a single object being depicted upon the retina as if double. 1. An unevenness of the cornea, which is divided into two, or more convex surfaces. There are cases, which show, that such an uneven shape may actually be the cause of double vision. (*Haller Element. Physiol. Tom. 5, p. 85.*) According to Beer, this conformation of the cornea is mostly a result of several preceding ulcers of that membrane, in which cir-

cumstance the patient sees with the affected eye not merely double, but treble, and quadruple, of which facts Beer has met with some examples. (*Lehre von den Augenkr. B. 2, p. 31.*) However, it must not be dissembled, that in a far greater number of instances, such unevenness of the cornea, though equally considerable, does not occasion this defect of sight. We have principally an opportunity of observing cases of this sort after the operation of extracting the cataract. Hence, it would seem, that the inequalities must be of very particular shape to produce double vision. The diagnosis of this cause is easy enough; but, the removal of it is impracticable: for, how is it possible to restore the original shape of the cornea? On this case, however, Beer delivers a more favourable prognosis than Richter, for he states, that when the patient is not decrepit, the double vision, from altered shape of the cornea, will gradually disappear of itself when proper care is taken of the constitution, and in particular of the eye. (*B. 2, p. 32.*) 2. An inequality of the anterior surface of the crystalline lens, whereby the same is divided into several distinct surfaces, it is suggested, may also be the occasion of diplopia. Such an inequality may possibly produce the disorder; but, it is exceedingly doubtful whether any case of this sort has ever been met with, and, as Richter properly remarks, the investigation is not worth undertaking, as the diagnosis and cure would be equally impracticable. The only possible method of cure would be the extraction, or depression, of the crystalline lens; yet, with the uncertainty respecting the nature of the cause, what man would be justified in performing an operation, in which the patient is not wholly exempt from the danger of losing his sight altogether? A double aperture in the iris, or as the case is termed, a double pupil, and a deviation of the pupil from its natural position, have been enumerated as causes of diplopia. (*Baumer in Act. Soc. Hassiac. 1, No. 27.*) However, Richter deems the reality of the first of these causes doubtful; for, cases have been noticed, where double vision was not the effect of there being two openings in the iris. (*Janin Mém. sur l'Oeil.*) But, were the disorder actually to originate in this way, it would not admit of a cure.

The causes of the second class, by the effect of which the object is represented, in regard to its size, position, distance, &c. differently in one eye from what it is in the other, are for the most part rather possible, than such as have been actually observed. The causes, which make objects assume an appearance contrary to the real one, may sometimes be confined to one eye, to which, things are depicted diversely from what they are to the other healthy eye, so that the patient sees, as it were double. Thus, for example, there may be a stronger refraction of the rays of light in one eye than the other; the patient may be a *myops* with one eye, and a *presbyops* with the other; and then the object will seem to one eye large,

to the other small, to one eye distant, to the other plainly near. This state of the sight, indeed, is said to have occurred after operating upon a cataract in one eye. (*Heuermann*) However, that this is not a common consequence of operating upon a cataract in one eye, while the other is perfect, is sufficiently clear, from what has been said upon the subject, in a foregoing part of this work. (See *Cataract*.) In particular examples, objects which are perpendicular seem to the patient to have a sloping posture. When it is considered, that only one eye is thus affected, and that to it things will appear sloping, and to the other straight, double vision must be the effect. A few remarks connected with this subject will be introduced hereafter. (See *Sight, Defects of*.)

When both eyes are so directed to an object, that it becomes situated in the axis of vision of each of these organs, such object is represented in both at the same place, that is, it is depicted upon that part of the retina, on which the axis of sight falls. Thus the object seems to both eyes to be in the same place, and, though the two organs discern the thing, it only communicates a single appearance. But, when one eye is turned to any object in a different direction from that of the other; that is to say, when one eye is turned to an object in such a way, that the object is situated in the axis of vision of this eye, while the opposite eye is so turned, that the same object is placed on one side of its axis of vision; in other words, when a person squints; the object is depicted in one eye upon a different part of the retina from what it is in the other; consequently, the object appears to the two respective organs to be differently situated, and the patient is affected with diplopia. This is the third species of this disorder, which arises from strabismus as a third kind of occasional cause. Such patients naturally see objects double only when they behold them with both eyes.

A person, who squints, usually has one eye stronger than the other, and the weakness of one of these organs is the common cause of the strabismus. Such a person does not see objects double, because he only sees with one eye well, and with the other so faintly and imperfectly, that scarcely any impression is made. Hence, every case of strabismus is not necessarily combined with diplopia; indeed, the common kind of squinting is not joined with it. A person, affected with strabismus, only sees double, when the sight of each eye is equally strong, and when the squinting does not depend upon any weakness of one of the eyes, but upon some other occasional causes. The principal causes of the latter sort are of a spasmodic nature, viz.: an irritation affects some muscle of the eye in such a manner, that the patient is incapacitated from moving both his eyes according to his will, and from directing them to any object, so that such object may be at once in the axis of vision of both. On this case, the observations of Sir E. Home are interesting, who has made many

accurate reflections on the effect of an irregular action of the straight muscles of the eye in producing double vision. (*Phil. Trans.* 1797.)

Richter states, that, in the majority of cases, the irritation alluded to is seated in the gastric organs, though he thinks, that, any other species of irritation may operate upon the eyes in a similar manner. This kind of diplopia is frequently attendant on other spasmodic diseases as a symptom. It often accompanies hypochondriasis. Sometimes, it is the consequence of violent pain. Richter informs us of a man, who saw double and squinted, during a severe headach. He states, that another was affected in the same way during a toothach. Sometimes, the diplopia is owing to a paralysis of one of the muscles of the eye; (*Morgagni de Sedibus et Causis Morborum, Epist. 13, art. 20*; a paralysis of the abductor muscle) sometimes, to a tumour in the orbit. The diagnosis of this kind of diplopia is free from difficulty; the patient having been affected with squinting ever since things appeared double to him.

The views which Sir E. Home took of diplopia from irregular action, spasm, or weakness, of any particular muscle of the eye, led him to propose a plan of treatment, the principle of which is to keep the muscle affected for a time, perfectly at rest, which is easily done, by covering the eye with a bandage, and not allowing the organ to be at all employed.

The fourth class of causes are such irritations as act upon the optic nerves, changing their sensibility in such a way, that objects do not make that sort of impression upon them, which they ought to do. Thus, things sometimes have the appearance of being coloured, when they are really not so; immoveable objects seem in motion, straight objects appear oblique, and in the cases, which we are now treating of, single things seem to the eye double, treble, &c. This faulty kind of sensibility may also be produced by irritation in eyes, which are perfectly sound; but it is most readily occasioned in eyes, which are preternaturally weak and irritable. In these very trivial and inconsiderable irritations will often excite it. In the treatment, the common indication is to discover and remove whatever irritation conduces to this effect; but, the attempt frequently fails. In irritable eyes, the disorder is often brought on by very slight irritations, which cannot always be diminished, or removed. Here, the grand indication is to cure the weakness and irritability of the organs.

According to Richter, the fourth class of causes of diplopia is the most frequent. The irritations are of various kinds, and generally seated in the abdominal viscera. Diplopia is sometimes the consequence of inebriety, foulness of the stomach, intermitting fevers, hypochondriasis, worms, &c. However, the complaint is occasionally excited by other sorts of irritation. It has frequently followed a violent fright. It may be con-

nected with spasmodic and painful diseases of several kinds. Severe headaches and toothachs are sometimes joined with this affection of the sight. Richter mentions a boy, who, being in the woods, was struck by the bough of a tree over the eye, and, in consequence of the accident became affected with diplopia. He informs us of a man, who rode a journey on horseback, along a snowy road on a very sun-shiny day, and was affected in the same manner. This affection of the eyes is sometimes the effect of injuries of the head. (See *Hill's Cases in Surgery*, p. 108. *Schmucker, Med Chir. Bermerk*, 1 B. No. 26. *Hennen's Principles of Military Surgery*, p. 346, Ed. 2.) Persons who have weak eyes, are apt to become double-sighted, whenever they look attentively for a long while at any light shining objects. Patients in fevers are also sometimes double-sighted. (*Gooch's Cases, &c. Vol. 2.*)

The irritation, productive of diplopia, may lead to other serious complaints of the eye, when it operates with great violence. Indeed, it frequently happens, that diplopia terminates in some other disorder of the eyes, and is often the forerunner of the worst diseases of these organs, particularly the gutta serena. The difficulty, or ease of the cure, partly depends upon the nature of the remote cause, and partly upon the condition of the eye. Some of the causes are easy, others difficult of removal. When the eye is very weak and irritable, the disorder frequently continues, notwithstanding the irritation has been removed. Also, when the complaint is relieved, it is exceedingly difficult to prevent a relapse, for on very irritable eyes, slight irritations, which cannot be hindered, are apt to produce a return of the affection. Therefore, the indication is to remove the existing defect of sight, and take means for the prevention of its return, or the commencement of any other. The weakness and preternatural irritability of the eye should be removed, as well as every sort of irritation, things which are often difficult of accomplishment.

The chief business of the surgeon in the treatment of this kind of diplopia, consists in endeavouring to find out and remove the irritation occasioning the disorder. The majority of such irritations are of the same nature as those, which give rise to the gutta serena. (See *Amaurosis*.) Indeed, both the complaints are often only different effects of the same cause, and of course require a similar mode of treatment. The boy whom Richter has mentioned, as having become double-sighted in consequence of being struck over the eye with the bough of a tree, was cured by the external use of the infusum radicis valerianæ and spiritus vini crocatus, with which the eyelids and adjacent parts were rubbed several times a day. A diplopia, which followed a violent fright, was cured by valerian, preceded by a few doses of cream of tartar. The case reported by Dr. Hennen, as proceeding from a gunshot wound of the soft parts, covering the root of the nose and right eyebrow,

yielded to abstinence, occasional emetics, and cold collyria. (*Principles of Mil. Surgery*, Ed. 2, p. 345.) A hypochondriacal patient got rid of the disorder by means of the warm bath. A diplopia, supposed to arise from disorder of the biliary secretion, was cured by means of pills made of gum-galbanum, guaiacum, rhubarb, and Venice soap, assisted with emetics and purgatives.

When the irritation, exciting the disorder, is only of temporary duration, as for instance, looking at shining objects; when the disorder continues after the removal of the irritation; or, lastly, when the irritation cannot be well detected; the surgeon is to endeavour, by means of nervous and soothing medicines, either to remove the impression which the irritation has left upon the nerves; or to render the nerves insensible to the continuing irritation. According to Richter the following remedies have proved useful in cases of diplopia: hartshorn, dropped into the hand, and held before the eyes; the external use of the spiritus vini crocatus; warm bathing of the eye, particularly in a decoction of white poppy heads; bathing the eye in cold collyria; the internal administration of bark, valerian, small doses of ipecacuanha, flowers of zinc, and oleum cajuput. In one instance, in which it was impossible to detect the cause, Richter states, that soluble tartar with ox's gall and castoreum was found of service; that, in another similar case, rhubarb, ox's gall, and assafoetida; and, in a third, liquor ammoniæ acetatæ with ox's gall, proved useful. This author further observes, that, in all cases, in which the particular cause of the disorder cannot be precisely determined, we may conjecture that such cause has its seat in the abdominal viscera; and that much benefit may often be derived from mild resolvents, evacuates, and anodyne medicines. (*Richter's Anfangsgr. der Wund-darzn. B. 3, Kap. 15.*)

According to Beer, the diplopia, which is not an effect of the continuance of another disease after inflammation of the eye, but probably depends upon injury of the retina, caused by such inflammation, usually diminishes, without the assistance of art, if the eye be not abused. (*Lehre von den Augenkr. B. 2, p. 32.*) For the foregoing account of diplopia I am chiefly indebted to Richter. See also A. Vater et J. C. Heinicke, *Visus Vitia duo rarissima; alterum duplicati, alterum dimidiati, &c. Wittemb. 1723.* (*Haller Diss. ad Morb. 1, 305.*) J. J. Klawhold de *Visu duplicato*, 4to. Argent. 1746. Buchner de *Visione simplici et duplici*, 4to. Argent. 1753. Euler, *Récherches Physiques sur la diverse réfrangibilité des rayons de lumière; Mém. de l'Acad. des Sciences, &c.; Berlin*, p. 200, 1754. *Klinke de Diplopia*, 4to. Goett. 1774. Sir E. Home's *Obs. on the straight Muscles of the Eye, and the structure of the Cornea*, in *Phil. Trans. for 1797*; B. Gooch, *Chir. Cases, &c. Vol. 2, p. 42, &c. 8vo. Lond.* 1792. Keggellini, *Lettera sopra l'offesa della cista in una Donna, &c. 8vo. Venet.* 1749; an instance of Diplopia from double pupil. *Dict.*

des Sciences, Med. T. 9, p. 497. J. Wardrop, Essays on the Morbid Anatomy of the Human Eye, Vol. 2, p. 216, &c. 8vo. Lond. 1818.

DIRECTOR. (from *dirigo*, to direct.)—

One of the most common instruments of surgery; it is long, narrow, grooved, and made of silver, in order that it may be bent into any desirable shape. Its use is to direct the knife, and protect the parts underneath from the edge or point of the latter instrument. The surgeon introduces the director under the parts, which he means to divide, and then either cuts down, along the groove of the instrument with a common bistoury, or cuts upward with a narrow, curved, pointed bistoury, the point of which is turned upwards, which he carefully introduces along the groove. This instrument and the crooked bistoury are commonly employed for opening sinuses, for cutting fistula in ano, and fistulæ in other situations, and for dilating the stricture in cases of hernia.

DISLOCATION. (from *disloce*, to put out of place.) *A Luxation.* When the articular surfaces of the bones are forced out of their proper situation, the accident is termed a *dislocation* or *luxation*.

Mr. Astley Cooper has justly remarked, that, of the various accidents which happen to the body, there are few which require more prompt assistance, or in which the reputation of the surgeon is more at stake, than cases of luxation; for, if much time be lost prior to the attempt at reduction, there is great additional difficulty in accomplishing it, and it is often entirely incapable of being effected. If it remains unknown, and consequently unreduced, the patient becomes a living memorial of the surgeon's ignorance or inattention. Hence, this experienced surgeon forcibly inculcates the careful study of anatomy; the want of an accurate knowledge of the structure of the joints being the chief cause of the many errors, which happen in the diagnosis and treatment of dislocated bones. The following passage cannot be too deeply impressed upon the surgeon's mind: "A considerable share of anatomical knowledge is required to detect the nature of these accidents, as well as to suggest the best means of reduction; and, it is much to be lamented, that our students neglect to inform themselves sufficiently of the structure of the joints. They often dissect the muscles of a limb with great neatness and minuteness, and then throw it away, without any examination of the ligaments, the knowledge of which, in a surgical point of view, is of infinitely greater importance; and from hence arise the numerous errors of which they are guilty, when they embark in the practice of their profession; for, the injuries of the hip, elbow, and shoulder, are scarcely to be detected, but by those who possess accurate anatomical information. Even our hospital surgeons, who have neglected anatomy, mistake these accidents; for, I have known the pullies applied to an hospital patient, in case of a fracture of the neck of the thigh-

bone, which had been mistaken for a dislocation, and the patient cruelly exposed, through the surgeon's ignorance, to a violent and protracted extension. It is therefore proper, that the form of the ends of the bones, their mode of articulation, the ligaments by which they are connected, and the direction in which the larger muscles act, should be well understood." (*Surgical Essays, Part 1, p. 2.*)

The most important differences of luxations are,—1. With respect to the articulation, in which these accidents take place;—2. The extent of the dislocation;—3. The direction in which the bone is displaced;—4. The length of time the displacement has continued;—5 The circumstances which accompany it, and which make the injury simple or compound;—6. And lastly, with respect to the causes of the accident.

1. Every kind of joint is not equally liable to dislocations. Experience proves, indeed, that, in the greater part of the vertebral column, luxations are absolutely impossible, the pieces of bone being articulated by extensive, numerous surfaces, varying in their form and direction, and so tied together by many powerful, elastic means, that very little motion is allowed. Experience proves, also, that the strength of the articulations of the pelvic bones can scarcely be affected by enormous efforts, unless these bones be simultaneously fractured. Boyer has therefore set down luxations of joints with continuous surfaces as impossible. (*Traité des Maladies, Chirurg. T. 4, p. 17.*) And, Mr. A. Cooper observes, that, in the spine, the motion between any two bones is so small, that dislocations hardly ever occur, except between the first and second vertebrae, although the bones are often displaced by fracture. (*Surgical Essays, p. 14.*)

In the articulations with contiguous surfaces, the facility with which dislocations happen, depends upon the extent and variety of motion in such joints. Thus, in the short bones of the carpus, and particularly of the tarsus, and at the carpal and tarsian extremities of the metacarpal and metatarsal bones, where flat broad surfaces are held together by ligaments, strong, numerous, and partly interarticular, and where only an obscure degree of motion can take place; dislocations are very unfrequent, and can only be produced by uncommon violence.

The loose joints, which admit of motion in every direction, are those in which dislocations most frequently occur; such is that of the humerus with the scapula. On the contrary, the ginglymoid joints, which allow motion only in two directions, are, comparatively speaking, seldom dislocated.—The articular surfaces of the latter are of great extent, and, consequently, the heads of the bones must be pushed a great way in order to be completely dislocated; and the ligaments are numerous and strong.

2. With respect to the extent of the dislocation, luxations are either *complete* or *incomplete*. The latter term is applied when

the articular surfaces still remain partially in contact. Incomplete dislocations only occur in ginglymoid articulations, as those of the foot, knee, and elbow: In these, the luxation is almost always incomplete; and very great violence must have operated, when they are completely dislocated. In the elbow, the dislocation is partial, with respect both to the ulna and radius. In the orbicular articulations, the luxations are almost invariably complete. However, "the os humeri sometimes rests upon the edge of the glenoid cavity, and readily returns into its socket."—(*A. Cooper, Essays, Part 1, p. 14.*) The lower jaw is sometimes partially dislocated in a manner different from what is commonly meant by this expression, viz. one of its condyles is luxated, while the other remains in its natural situation.

As Mr. A. Cooper has explained, a partial dislocation sometimes occurs at the ankle joint. "An ankle (says he) was dissected at Guy's, and given to the collection of St. Thomas's, which was partially dislocated: the end of the tibia rested still in part upon the astragalus, but a large portion of its surface was seated on the os naviculare, and the tibia, altered by this change of place, had formed two new articular surfaces, with their faces turned in opposite directions towards the two bones. The dislocation had not been reduced."

3. In the orbicular joints, the head of the bone may be dislocated at any point of their circumference; and the luxations are named accordingly *upward, downward, forward, and backward*. In the ginglymoid articulations, the bones may either be dislocated laterally, or forward or backward.

4. The length of time a dislocation has existed, makes a material difference. In general, recent dislocations may be easily reduced; but, when the heads of the bones have been out of their places, for several days, the reduction becomes exceedingly difficult, and in other cases, very often impossible. The soft parts, and the bone itself, have acquired a certain position: the muscles have adapted themselves in length to the altered situation of the bone, to which they are attached, and sometimes, cannot be lengthened sufficiently to allow the bone to be reduced. Desault and Boyer believe, that frequently the opening in the capsular ligament soon becomes closed, and hinders the return of the head of the bone into its original situation; a statement, which does not coincide with the sentiments of Mr. A. Cooper. (*Surgical Essays, Part 1, p. 18.*) Lastly, the luxated bone may become adherent to the parts on which it has been forced.

5. The difference is immense, in regard to the danger of the case, arising from the circumstance of a dislocation being attended, or unattended, with a wound, communicating, internally with the joint, and externally with the air. When there is no wound of this kind, the danger is generally trivial, and the dislocation is termed a *simple one*: when there is such a wound, together with the

dislocation, the case is denominated *compound*, and is frequently accompanied with the most imminent peril. Indeed, the latter kind of accident often renders amputation proper.

6. The causes of dislocations are external and internal. A predisposition to such accidents may depend on circumstances natural, or accidental. The great latitude of motion, which the joint admits of; the little extent of the articular surfaces; the looseness and fewness of the ligaments; the lowness of one side of the articular cavity, as, at the interior and inferior part of the acetabulum; and the shallowness of the cavity, as of that of the capsula; are natural predisposing causes of luxations.

A paralytic affection of the muscles of a joint, and a looseness of its ligaments, are also predisposing causes. When the deltoid muscle is paralytic, the mere weight of the arm has been known to cause such a lengthening of the capsular ligament of the shoulder joint, that the head of the os brachii descended two or three inches from the glenoid cavity.

Two cases, strikingly illustrative of the tendency to dislocation from a weakened, or paralytic state of the muscles, are recorded by Mr. A. Cooper. The first is that of a junior officer of an India ship, who, for some trifling offence, had been placed with his foot upon a small projection on the deck, while his arm was kept forcibly drawn up to the yard-arm for an hour. "When he returned to England, he had the power of readily throwing that arm from its socket, merely by raising it towards his head; but, a very slight extension reduced it. The muscles were wasted, also, as in a case of paralysis." The other example happened in a young gentleman, troubled with a paralytic affection of his right side from dentition. "The muscles of the shoulder were wasted, and he had the power of throwing his os humeri over the posterior edge of the glenoid cavity of the scapula, from whence it became easily reduced." In these cases, Mr. A. Cooper observes, that no laceration of the ligaments could have occurred, and they show the influence of the muscles in preventing dislocation, and in impeding reduction. (*Surgical Essays, Part 1, p. 10.*)

The looseness of the ligaments sometimes makes the occurrence of dislocations so easy, that the slightest causes produce them. Some persons cannot yawn, or laugh, without running the risk of having their lower jaw luxated. On this account, collections of fluid within the knee, causing a relaxation of the ligament of the patella, are often followed by a dislocation of that bone. And, whenever a bone has been once dislocated, it ever afterwards has a tendency to be displaced again by a slighter cause, than what was first necessary to produce the accident: This tendency, indeed, increases with every new displacement.

Such diseases, as destroy the cartilages, ligaments, and articular cavities of the

bones, may give rise to a dislocation. The knee is sometimes, but not frequently, partially luxated in consequence of a white swelling; the thigh is often dislocated in consequence of the acetabulum and ligaments being destroyed by what is commonly named the disease of the hip-joint. Such dislocations are termed *spontaneous*.

In the anatomical collection at St. Thomas's Hospital, there is a preparation of a knee, dislocated in consequence of ulceration, and ankylosed, the leg forming a right angle with the femur directly forwards. (See *A. Cooper's Surg. Essays, Part 1, p. 11.*)

An enarthrosis joint can only be dislocated by external violence, a blow, a fall, or the action of the muscles, when the axis of the bone is in a direction, more or less oblique, with respect to the surface with which it is articulated.

Any external force may occasion a dislocation (generally incomplete) in the ginglymoid joints; but, in the ball and socket articulations, the action of the muscles constantly has a share in producing the accident. So, when a person falls on his elbow, while his arm is raised outwards from his side, the force, thus applied, will undoubtedly contribute very much to push the head of the os brachii out of the glenoid cavity, at the lower and internal part. Still, the sudden action of the pectoralis major, latissimus dorsi, and teres major, which always takes place from the alarm, will also aid in pulling downward and inward the head of the bone. Under certain circumstances, the violent action of the muscles alone may produce a dislocation without the conjoint operation of any outward force. But, when the patient is aware in time of the violence, which is about to operate, and his muscles are prepared for resistance, a dislocation cannot be produced without the greatest difficulty, (*A. Cooper, op. cit. p. 15.*) unless the posture of the member at the moment be such as to render the action of the strongest muscles conducive to the displacement, instead of preventive of it, as is frequently the case in luxations of the shoulder.

Dislocations are constantly attended with more or less laceration or elongation of the ligaments: and, in the shoulder and hip, the capsules are always torn, when the accident has been produced by violence. Some instances, in which the ligaments are only lengthened and relaxed, I have already quoted.

SYMPTOMS OF DISLOCATIONS.

As Boyer justly observes, there is not any dislocation, which does not produce pain and incapacity in the limb; but, these symptoms are only equivocal, and cannot distinguish the case from a fracture; nor even from a simple contusion. He divides the symptoms of dislocations into those which may be collected from the circumstances attending the occurrence of the accident; and into others, which he calls present, or positive.

In order that a dislocation may happen, there must be a particular attitude of the limb during the action of the external violence. Indeed the displacement can hardly occur from the direct action of the cause on the articulation itself. The action of the luxating cause is the more efficient, the further it is from the joint, and the longer the lever is, which it affects. Thus, in a fall on the side, when the arm, raised considerably from the trunk, has had to sustain all the weight of the body on a point at its inner side, the probability of a dislocation is evident, and even that the head of the bone has been forced through the lower portion of the capsular ligament.

But, the symptoms, which Boyer terms positive, or actually present, are numerous and clear:

1. In dislocations of orbicular joints, and complete luxations of ginglymoid joints, the articular surfaces are not at all in contact, and the point, where the dislocated bone is lodged, cannot be upon the same level with the centre of the cavity, from which it has been forced. Hence, a change in the length of the limb. In the ginglymoid joints, such alteration can only be a shortening proportioned to the extent of the displacement; for there is then an overlapping of the bones, similar to that of the fragments of a fracture, longitudinally displaced. But in the orbicular joints, the bone may be displaced and carried above, or below, the articular cavity, so that, in the first event, a shortening, in the second, an elongation of the limb, will be produced. But, as the direction of the member is at the same time altered, it is not always practicable to place the limbs parallel together, nor to bring them near the trunk, for the purpose of judging whether they are lengthened or shortened. A comparison, however, made without this advantage, will generally enable the surgeon to form a correct opinion. The proper length of a dislocated limb cannot be restored, except by putting the bone back into the cavity, from which it has slipped. In general, this cannot be accomplished without considerable efforts, while a slight exertion is usually sufficient to obtain the same effect in cases, where the shortening of the limb depends upon a fracture. It is also particularly worthy of notice, that, when once the natural length of the limb has been restored in dislocations, it remains, while there are a great many fractures, in which the shortening of the member recurs after it has been made to disappear. The surgeon must also recollect, that an elongation of the limb can never happen in cases of fracture, as it does in certain dislocations.

2. In almost all complete luxations, the direction of the axis of the limb is unavoidably altered. This circumstance arises from the resistance of that portion of the articular ligaments, which has not been ruptured, as well as from the action of the muscles. In complete lateral dislocations of ginglymoid joints, the direction of the axis of the

limb is not altered, on account of the total rupture of the ligaments, and even of a part of the surrounding muscles. Neither is this observable in incomplete dislocations of such articulations, on account of the extent of the articular surfaces. But, it is strongly marked in complete luxations of these joints, where the displacement has happened in the direction of the articular movements, although in cases of this description the ligaments must be totally ruptured. The muscles, which have suffered less, are in a state of extreme tension, and must necessarily alter the axis of the limb. The tension of certain muscles, and the preservation of some of the ligaments, especially in the orbicular joints, are also a cause of a rotatory movement of the dislocated limb at the moment of the displacement, and which it afterwards retains. Thus, in luxations of the thigh, the toes and knee are turned outward, or inward, according as the head of the thigh bone happens to be situated at the inside, or outside of the joint. These two kinds of alteration in the direction of the limb are permanent when they depend upon a dislocation; a circumstance quite different from what is observable in fractures, where the same changes occur, but can be made to cease at once without any particular effort.

3. The absolute immobility of a limb, or, at least, the inability of performing certain motions, is among the most characteristic symptoms of a dislocation. In some complete luxations of particular ginglymoid joints, the dislocated limb is absolutely, or very nearly incapable of any motion. Thus, in the dislocation of the fore-arm backwards, the particular disposition of the bones, and the extreme tension of the extensor and flexor muscles, confine the limb in the half-bent state, and at the same time resist every spontaneous motion, and likewise almost every motion which is communicated. In the orbicular joints, the painful tension of the muscles, which surround the luxated bone, nearly impedes all spontaneous movements, but, in general, analogous motions to that, by which the displacement was produced, can be communicated to the limb, though not without exciting pain. Thus, in the dislocation of the humerus downward, the elbow hardly admits of being put near the side, nor of being carried forward, and backward; but it can be raised up with ease. In the dislocation of the acromial end of the clavicle, the patient can bring the arm towards the trunk, separate it a little from the side, or carry it forward or backward; for he cannot raise it in a direct way. Lastly, in complete lateral dislocations of such joints, as have alternate motions, the patient has the power of performing no motion of the part; but, the complete destruction of all the means of union allows the limb to obey every species of extraneous impulse, and this symptom, which is besides never single, makes the nature of the case sufficiently manifest.

Sometimes, as Mr. A. Cooper has re-

marked, a considerable degree of motion continues for a short time after a dislocation: thus, in a man brought into Guy's Hospital, whose thigh bone had just been dislocated into the foramen ovale, a great mobility of the femur still remained; but, "in less than three hours it became firmly fixed in its new situation by the contraction of the muscles." (*Surgical Essays, Part 1, p. 3.*)

4. In dislocations with elongation of the displaced limb, the general and uniform tension of all the muscles arranged along it, gives to these organs an appearance as if they lay nearer the circumference of the bone, and the limb were smaller than its fellow. The muscles, however, which belong to the side, from which the dislocated bone has become more distant, appear more tense than the others, and form externally a prominent line. This is very manifestly the case with the deltoid muscle, when the arm is luxated downward. On the contrary, in dislocations where the limb is shortened, the muscles are relaxed; but, being irritated, they contract and accommodate themselves to the shortened state of the limb.—Hence, the extraordinary swelling of their fleshy part, and the manifest tumefaction of the portion of the member, to which they belong. We have a striking example of this in the dislocation of the thigh upward and outward, where the muscles at the inside of the limb form a distinct oblong tumour.

The parts, which surround the affected joint, also experience alterations in their form, whenever muscles, connected with the dislocated bone, occupy that situation. Thus, in dislocations of the thigh, the buttock on the same side is flattened, if the bone is carried inward; but, it is more prominent, when the thigh bone is carried outward; and its lower edge is situated higher, or lower, than in the natural state, according as the luxation may have taken place upward or downward. In the complete luxation of the fore-arm backward, the triceps is tense, and forms a cylindrical prominence, owing to the displacement of the olecranon backward, in which displacement it is obliged to participate.

5. The circumference of the joint itself presents alterations of shape well deserving attention, and, in order to judge rightly of this symptom, correct anatomical knowledge is of high importance.

The form of the joints principally depends upon the shape of the heads of the bones. Hence, the natural relation of the bones to each other cannot be altered without a change being immediately produced in the external form of the joint. The changes, which the muscles, passing over the luxated joint, at the same time undergo in their situation and direction, contribute likewise to the difference of shape, by destroying the harmony of what may be called the outlines of the limb.

When the head of a bone, articulated by enarthrosis, has slipped out of the cavity, instead of the plumpness, which previously

indicated the natural relation of parts, the head of the dislocated bone may be distinguished at some surrounding point of the articulation, while at the articulation itself may be remarked a flatness, caused by one of the neighbouring muscles stretched over the articular cavity, and more deeply may be perceived the outline and depression produced by this cavity itself. The bony eminences, situated near the joint, and whose outlines were gradually effaced in the general form of the member, are rendered much more apparent by the displacement, and project, in a stronger degree, than in the natural state. On this part of the subject, Mr. A. Cooper is particularly correct, when he observes, that the head of the bone can generally be felt in its new situation, excepting in some of the dislocations of the hip, and its rotation is often the best criterion of the accident. *The natural prominences of bone near the joint, either disappear, or become less conspicuous, as the trochanter at the hip-joint. Sometimes the reverse occurs; for in dislocations of the shoulder, the acromion projects more than usual.* (*Surg. Essays, Part 1, p. 4.*)

The lines, made by the contour of the limb and the natural relation of the bones, are so manifestly broken in dislocations of ginglymoid joints, that, when there is no inflammatory swelling, the case is intelligible in an instant. More certain knowledge, however, and more correct information, respecting the kind of displacement, are to be obtained by attentively examining the changes of position, which the bony prominences, forming the termination of the bones articulated together, have undergone, and which are the more obvious in these joints, inasmuch as they give attachment to the principal muscles. The natural relations of these processes being known, the least error of situation ought to strike the well-informed attentive practitioner. Thus, in the elbow joint, a considerable difference in the respective height, and in the distances between the olecranon and internal and external condyles, can be easily distinguished. But, the thing is less easy when the surrounding parts are so swelled and tense, as to make the bony projections deeper from the surface, and less obvious to examination. Even then, however, a good surgeon will at least find something to make him suspect the dislocation, and the suspicion will be confirmed when he again examines the part on the swelling beginning to subside. It is of the utmost consequence to make out what the case is as early as possible; for, the unnatural state, in which the soft parts are placed, keeps up the swelling a long while; and if the surgeon wait till this has entirely subsided, before he ascertains that the bones are luxated, he will have waited till it is too late to think of reducing them, and the patient must remain for ever afterward deprived of the free use of his limb. (*Boyer, Traité des Maladies Chir. T. 4, p. 45, &c.*) It is not only the inflammatory swelling, which may tend to conceal the

state of the ends of the bone; sometimes a quicker tumour arises from the effusion of blood in the cellular membrane, and causes an equal difficulty of feeling the exact position of the heads of the bones.

Dislocations are also, sometimes, attended with particular symptoms, arising altogether from the pressure caused by the head of the luxated bone on certain parts. The sternal end of the clavicle has been known to compress the trachea, and impede respiration: the head of the humerus may press upon the axillary plexus of nerves, and produce a paralytic affection of the whole arm. In one instance, cited by Mr. A. Cooper, a dislocated clavicle pressed upon the œsophagus, and endangered life. (*Surg. Essays, Part 1, p. 4.*)

As Kirkland has observed, there are some luxations, which are far worse injuries than fractures: of this description, are dislocations of the vertebræ, cases which, indeed, can hardly happen without fracture, and are almost always fatal; dislocations of the long bones, with protrusion of their ends through the muscles and skin, and severe inflammation, extensive abscesses, attended with great risk of being followed by large and tedious exfoliations, and not unfrequently gangrene.

According to Mr. A. Cooper, young subjects rarely experience dislocations; their bones break, or their epiphyses give way much more frequently than the articular surfaces are displaced. (*Surg. Essays, Part 1, p. 16.*) Suspected luxations of the hip in children commonly turn out to be disease of the joint, one instance of which is given by the preceding author, and an example of which I was lately consulted about myself. Also, when a dislocation of the elbow is suspected in a child, because the bone appears readily to return into its place, but directly to slip out of it again, Mr. A. Cooper says, that the case is an oblique fracture of the condyles of the humerus.

PROGNOSIS.

In general, every unreduced dislocation, must deprive the patient more or less completely of the use of the limb; for, nature cannot in any of these cases re-establish the natural relations which are lost. There is indeed an effort made to restore some of the motions, and the use of the limb in a certain degree: but, it is always very imperfectly accomplished, and in the best cases, only a confined degree of motion is re-established. Nature cannot in any way alter the lengthened or shortened state of the limb; and she can only correct in a very imperfect manner its faulty direction.—There are even some cases, in which nature can effect no amendment whatsoever; as, for instance, complete dislocations of ginglymoid joints in the direction of the articular movements: here so great an alteration would be requisite in the surfaces in contact, and so extensive an elongation of the muscles, that the dislocated part must continue nearly motionless.

There are, however, a few exceptions to this general rule. The arthrodia joints are seldom extensively displaced; and as, in the natural state, their motions are very limited, the loss of these motions, in consequence of the natural relations not having been restored, is of less importance.—Thus, the bones of the carpus, those of the tarsus, and the acromial end of the clavicle, may be dislocated, and be reduced either imperfectly, or not at all, without the functions of the limb, to which they belong, being materially impaired. (*Boyer, Traité des Maladies Chir. T. 4, p. 54.*)

Dislocations of enarthrosis are generally much less dangerous, than those of ginglymoid joints; for, the action of the muscles has a great share in producing the former; the violence done to the external parts is less; and the laceration of the soft parts is not so considerable. Even in the same kind of joints, the seriousness of the case depends on the largeness of the articular surfaces, and the number and strength of the muscles and ligaments.

Dislocations of the ginglymoid joints, however, are more easily reduced than those of enarthrosis articulations, the muscles of which are frequently very powerful, and capable of making great resistance to the efforts of the surgeon. This is frequently seen in luxations of the shoulder and thigh.

It may be said, however, of the luxations of enarthrosis joints, that, if they happen the most easily, they are attended with less injury; and that, although their reduction may require considerable efforts, yet it can be accomplished, and the accident leaves no ill effects. On the contrary, in dislocations of ginglymoid joints, the same reason which renders them more unfrequent, makes them also more serious. The solidity of these joints prevents the uniting means from being destroyed, except by great violence; and the extent of the articular surfaces does not permit a considerable displacement, especially a complete one, without extensive injury of the ligaments, and surrounding soft parts. It is for these reasons, no doubt, that compound luxations and protrusions of the heads of the bones, are most commonly seen in the ginglymoid articulations.

Still it must be allowed, that the incomplete dislocations of these joints, unattended with much displacement, are not at all serious accidents.

The more recent a luxation is, the more easy it is to reduce, and therefore, *ceteris paribus*, the less grave is the injury. In this point of view, dislocations of ginglymoid joints are the most serious, because they soon become irreducible.

Simple dislocations are much less dangerous, than those which are complicated with contusion, the injury of a large nerve, or blood-vessel, inflammatory swelling, fracture, wound, and, especially, a protrusion of one of the articular surfaces. (*Boyer, Traité des Maladies Chir. T. 4, p. 55, 56.*)

Dislocations from ulceration and suppuration in joints, termed *spontaneous luxations*, cannot admit of reduction: when they arise from the hip-disease, it is not merely in consequence of the ligaments being destroyed, the brim of the acetabulum itself is often annihilated. However, there are other *spontaneous* dislocations from preternatural looseness of the ligaments, where reduction may be accomplished with the greatest facility; though in these instances, the displacement generally recurs from the slightest causes.

TREATMENT OF DISLOCATIONS IN GENERAL.

Mr. Pott observes:—By what our forefathers have said on the subject of luxations, and by the descriptions and figures which they have left us of the means they used, of what they call their organs and machinements, it is plain, that force was their object, and that whatever purposes were aimed at or executed by these instruments or machines, were aimed at and executed principally by violence. Many, or most of them, are much more calculated to pull a man's joints asunder, than to set them to rights.—Hardly any of them are so contrived as to execute the purpose for which they should be used, in a manner most adapted to the nature or mechanism of the parts on which they are to operate. The force or power of some of the instruments is not always determinable as to degree, by the operator, and consequently may do too little or too much, according to different circumstances in the case, or more or less caution or rashness in the surgeon. If in the diagnosis of these accidents, an exact knowledge of the ligaments is of the highest importance, a familiar acquaintance with the muscles is not less essential in the treatment.

In dislocations, as in fractures, says Pott, our great attention ought to be paid to the muscles belonging to the part affected. These are the moving powers, and by these the joints, as well as other moveable parts, are put into action; while the parts to be moved are in right order and disposition, their actions will be regular and just, and generally determinable by the will of the agent, (at least in what are called voluntary motions,) but when the said parts are disturbed from that order and disposition, the action or power of the muscles does not therefore cease; far from it, they still continue to exert themselves occasionally, but instead of producing regular motions, at the will of the agent, they pull and distort the parts they are attached to, and which by being displaced, cannot perform the functions for which they were designed.

Hence principally arise the trouble and difficulty which attend the reduction of luxated joints. The mere bones composing the articulations, or the mere connecting ligaments, would in general afford very little opposition; and the replacing the dislocation would require very little trouble or force, was it not for the resistance of the muscles and tendons attached to and con-

nected with them: for by examining the fresh joints of the human body, we shall find, that they not only are all moved by muscles and tendons, but also, that although what are called the ligaments of the joints do really connect and hold them together, in such manner as could not well be executed without them, yet in many instances, they are, when stript of all connexion, so very weak and lax, and so dilatible and distractable, that they do little more than connect the bones and retain the synovia; and that the strength as well as the motion of the joints, depends in great measure on the muscles and tendons connected with and passing over them; and this in those articulations which are designed for the greatest quantity, as well as for celerity of motion. Hence it must follow, that as the figure, mobility, action, and strength of the principal joints, depend so much more on the muscles and tendons in connexion with them, than on their mere ligaments, that the former are the parts which require our first and greatest regard, these being the parts which will necessarily oppose us in our attempts for reduction, and whose resistance must be either eluded or overcome; terms of very different import, and which every practitioner ought to be well apprised of." (See *Pott's Chir. Works*, Vol. 1.)

That the muscles are the chief cause of resistance is strongly evinced by cases, in which the dislocation is accompanied with injury of any vital organ; for then the bone may be reduced by a very slight force. Thus, in a man, who had an injury of his jejunum, and a dislocation of his hip, the bone was most easily replaced. (*A. Cooper, Surgical Essays*, Part 1, p. 20.) In short, any thing which produces faintness or weakness, facilitates the reduction of dislocated bones, as intoxication, nausea and sickness, paralysis, &c.

The following, which are some of the principles laid down by Mr. Pott, merit attention.—

1. Although a joint may have been luxated by means of considerable violence, it does by no means follow, that the same degree of violence is necessary for its reduction.

2. When a joint has been luxated, at least one of the bones of which it is composed, is detained in that unnatural situation by the action of some of the muscular parts in connexion with it; which action, by the immobility of the joint, becomes as it were tonic, and is not under the direction of the will of the patient.

3. That all the force used in reducing a luxated bone, be it more or less, be it by hands, towels, ligatures, or machines, ought always to be applied to the other extremity of the said bone, and as much as possible to that only. Mr. Pott argues, that if the extending force were applied to a distant part of the limb, or to the bone below or adjoining, it would necessarily be lost in the articulation which is not luxated, owing to the yielding nature of the ligaments, and be of

little or no service, in that which is dislocated. This remark, though made by Pott, and generally received as true, is very incorrect; for, it tends to state, that if you pull at the ankle, or wrist, the force does not operate on the hip, or shoulder.

4. That in the reduction of such joints, as are composed of a round head, received into a socket, such as those of the shoulder and hip, the whole body should be kept as steady as possible.

5. That in order to make use of an extending force with all possible advantage, and to excite thereby the least pain and inconvenience, it is necessary that all parts serving to the motion of the dislocated joint, or in any degree connected with it, be put into such a state as to give the smallest possible degree of resistance.

6. That in the reduction of such joints as consist of a round head, moving in an acetabulum or socket, no attempt ought to be made for replacing the said head, until it has by extension been brought forth from the place where it is, and nearly to a level with the said socket. This will show us, says Mr. Pott, a fault in the common ambi, and why that kind of ambi, which Mr. Freke called his commander, is a much better instrument than any of them, or indeed than all; because it is a lever joined to an extensor; and that capable of being used with the arm, in such position as to require the least extension, and to admit the most; besides which it is graduated, and therefore perfectly under the dominion of the operator. It will show us, why the old method by the door or ladder, sometimes produced a fracture of the neck of the scapula; as Mr. Pott saw it do himself. Why if a sufficient degree of extension be not made, the towel over the surgeon's shoulder, and under the patient's axilla, must prove an impediment rather than an assistance, by thrusting the head of the humerus under the neck of the scapula, instead of directing it into its socket. Why the bar, or rolling-pin, under the axilla, produces the same effect. Why the common method of bending the arm (that is, the os humeri) downward, before sufficient extension has been made, prevents the very thing aimed at, by pushing the head of the bone under the scapula, which the continuation of the extension for a few seconds only would have carried into its proper place. To the observation, that mere extension only draws the head of the bone out from the axilla, in which it is lodged, but does not replace it in the acetabulum scapulæ, Mr. Pott replies, that, when the head of the os humeri is drawn forth from the axilla, and brought to a level with the cup of the scapula, it must be a very great and very unnecessary addition of extending force, that will or can keep it from going into it. All that the surgeon has to do, is to bring it to such level; the muscles attached to the bone will do the rest for him, and that whether he will or not.

7. Another of Pott's principles is, that whatever kind or degree of force may be

found necessary for the reduction of a luxated joint, that such force be employed gradually; that the lesser degree be always first tried, and that it be increased gradatim. (See *Pott's Chir. Works*, Vol. 1.)

The supposition of the reduction being sometimes prevented by the capsular ligaments, Mr. A. Cooper considers as quite erroneous: he assures us, that in dislocations from violence, those ligaments are always extensively lacerated; and that the idea of the neck of the bone being girt, or confined, by them, is altogether untrue. (*Surg. Essays*, Part 1, p. 18.) But, in addition to the resistance of the muscles, there are in old dislocations three circumstances, pointed out by Mr. A. Cooper as causes of the difficulty of reduction. 1. The extremity of the bone contracts adhesion to the surrounding parts, so that in dissection, even when the muscles are removed, the bone cannot be reduced. 2. The socket is sometimes filled up with adhesive matter. 3. A new bony socket is sometimes formed, in which the head of the bone is so completely confined, that it could not be extricated without breaking its new lodgment. (*Surgical Essays*, Part 1, p. 21.)

Dislocations in general cannot be reduced without trouble; but, after the reduction is accomplished, it is easily maintained. On the contrary, fractures are for the most part easy of reduction; but cannot be kept in this desirable state without difficulty. The moment extension is remitted, the muscles act, the ends of the broken bone slip out of their proper situation with respect to each other, and the distortion of the limb recurs. As a modern writer has observed, the reduction is only a small part of the treatment of fractures: the most essential point of it is the almost daily care, which a fracture demands during the whole time requisite for its consolidation. The contrary is the case in luxations. Here, in fact, the reduction is every thing, if we put out of consideration the less frequent cases, in which the dislocation is complicated, and attended with such grave circumstances, as render it indispensably necessary to continue for a length of time the utmost surgical care. But, even then, the protracted treatment is less for the dislocation itself, than for the extraordinary circumstances, with which it is accompanied. (See *Roux, Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise*, p. 207.)

All the ancient writers recommend the extending force to be applied to the luxated bone; for instance, above the knee in dislocations of the thigh-bone, and above the elbow in those of the humerus. We have stated, that Pott, advised this plan, and the same practice, which is approved by J. L. Petit, Duverney, and Callisen, is almost generally adopted in this country.

However, many of the best modern surgeons in France, for instance, Fabre, D'Apouy, Desault, Boyer, Richerand, and Leveillé, advise the extending force not to be applied on the luxated bone, but on that

with which it is articulated, and as far as possible from it. It is said that this plan has two most important advantages: first, the muscles, which surround the dislocated bone, are not compressed, nor stimulated to spasmodic contractions, which would resist the reduction; secondly, the extending force is much more considerable, than in the other mode; for, by using a long lever, we obtain a greater degree of power.

In Pott's remarks, we find even him, influenced by the prevailing prejudice against the above practice, that part of the extending force is lost on the joint, intervening between the dislocation, and the part at which the extension is made. This notion is quite unfounded, as every man who reflects, for one moment, must soon perceive. When extension is made at the wrist, the ligaments, muscles, &c. which connect the bones of the fore-arm with the os brachii, have the whole of the extending force operating on them, and they must obviously transmit the same degree of extension, which they receive, to the bone above, to which they are attached. Indeed, this matter seems so plain, that I think it would be an insult to the reader's understanding to say any more about it, than that such eminent surgeons, as have contrary sentiments, can never have taken the trouble to reflect for themselves on this particular subject. Wheteer the force, necessary to be exerted in some instances, would have a bad effect on the intervening joint, may yet be a question; but, as Desault's practice was very extensive, and he did not find any objection of this kind, perhaps, we have no right to conclude, that such a one would exist.

If, however, the common objection to Desault's plan of applying the extending force be unfounded, the question still remains to be settled, whether this practice is most advantageous on the grounds above specified? This is a point, which, perhaps, cannot be at once peremptorily decided altogether in the negative, or the affirmative, since what may be best in one kind of dislocation, may not be so in another. Thus, Mr. A. Cooper states, that, as far as he has had an opportunity of observing, it is generally best to apply the extension to the bone, which is dislocated; but, that dislocations of the shoulder are exceptions, in which he mostly prefers to reduce the head of the bone by placing his heel in the axilla, and drawing the arm at the wrist in a line with the side of the body, whereby the pectoralis major and latissimus dorsi are kept in a relaxed state. (*Surgical Essays*, Part 1, p. 25.)

Extension may either be made by means of assistants, who are to take hold of napkins, or sheets, put round the part, at which it is judged proper to make the extension; or else a multiplied pulley may be used. In cases of difficulty, Mr. A. Cooper thinks the pulley should always be preferred. "When assistants are employed, their exertions are sudden, violent, and often ill-directed, and the force is more likely to produce laceration

tion of parts, than to restore the bone to its situation. Their efforts are also often uncombined, and their muscles are necessarily fatigued, as those of the patient, whose resistance they are employed to overcome." In dislocations of the hip joint, and in those of the shoulder which have been long unreduced, pulleys should always be employed. (*A. Cooper, Surgical Essays, Part 1, p. 24.*) But, whether pulleys be used, or not, nothing more need be added to what Mr. Pott has stated, concerning the propriety of using moderate force in the first instance, and increasing the extending power very gradually.

The extension should always be first made in the same direction, in which the dislocated bone is thrown; but, in proportion as the muscles yield, the bone is to be gradually brought back into its natural position. Thus the head of the bone becomes disengaged from the parts, among which it has been placed, and is brought back to the articular cavity again by being made to follow the same course, which it took in escaping from it.

Extension will prove quite unavailing, unless the bone, with which the dislocated head is naturally articulated, be kept motionless by counter-extension, or a force at least equal to the other, but made in a contrary direction.

The mode of fixing the scapula and pelvis, in luxations of the shoulder and thigh, will be hereafter described.

In dislocations of ginglymoid joints, extension and counter-extension are only made, for the purpose of diminishing the friction of the surfaces of the joints, so as to be enabled to put them in their natural situation.

When the attempts at reduction fail, the want of success is sometimes owing to the extension not being powerful enough, and the great muscular strength of the patient, which counteracts all efforts to replace the bone.

In the latter case, the patient may be freely bled, and put into a warm bath, so as to make him faint. The opening in the vein should be made large, because a certain evacuation of blood is more likely to produce weakness and swooning, than a gradual discharge of it; and the patient, for the same reason, may be bled as he stands up. In very difficult cases, the expedient of intoxication has been recommended, as when the patient is in this state, his muscles are incapable of making great resistance to reduction. Under these circumstances, opium is also frequently administered, with advantage. When the muscles make considerable opposition, Mr. A. Cooper, instead of bleeding and the warm bath, has sometimes given nauseating doses of tartarized antimony; a practice, which has been occasionally adopted by others. The medicine should be exhibited in repeated doses, until nausea is excited; but, it is not necessary to make the patient vomit; for, as soon as the nauseating effect is produced, "the mus-

cles lose their tone, and dislocations can be reduced with comparatively less effort, and at a more distant time from the accident, than can be effected in any other way." (*A. Cooper, Surgical Essays, Part 1, p. 22.*) In cases of unusual difficulty, this method, together with the warm bath and bleeding, seems rational and judicious: but, except in cases of that description, I should prefer long-continued, unremitting, not too violent, extension, which will at last overcome the muscles of the most athletic man. Sometimes, the resistance made to reduction by such muscles, as act in obedience to the will, may be eluded by the patient's attention being suddenly taken from the injured part, at which moment the action of those muscles is suspended, and a very little effort on the part of the surgeon will reduce the bone. A case, illustrating this circumstance, is recorded by Mr. A. Cooper. (*Part 1, p. 25.*)

Dislocations of orbicular joints can seldom be reduced, after a month, though Desault used to succeed, with great violence, at the end of three or four. Dislocations of ginglymoid articulations generally become irreducible in twenty, or twenty-four days, in consequence of ankylosis.

The reduction of a dislocation is known by the limb recovering its natural length, shape, and direction, and being able to perform certain motions, not possible while the bone was out of its place. The patient experiences a great and sudden diminution of pain; and, very often, the head of the bone makes a noise at the moment when it returns into the cavity of the joint.

In order to keep the bone from slipping out of its place again, we have only to hinder the limb from moving. When splints can act powerfully in steadying the joint, they are very often used, as in dislocations of the ankle, wrist, &c. As the humerus cannot be luxated, except when at some distance from the body, a return of its dislocation will be prevented by confining the arm close to the side in a sling. The spica bandage, applied after such an accident, is more satisfactory to the patient, than really efficacious. Whatever bandage is used to keep the arm from moving, should be put on the lower end of the bone, as far as possible from the centre of motion.

COMPOUND DISLOCATIONS.

Compound Dislocations are those, which are attended with a wound communicating with the cavities of the injured joints. In most instances, this opening in the skin is caused by the protrusion of the bone, but sometimes by the part having struck against some hard, or irregular body. These accidents are frequently attended with great danger; and the same nicety of judgment is requisite in determining, whether amputation ought to be immediately performed, or an effort made to preserve the limb, as in cases of compound fractures, and bad gunshot injuries; and many of the observations

which I shall have to offer upon the latter subjects, will for the most part, be applicable to the present.

The luxation of a large joint, being conjoined with an external wound, leading into the capsular ligament, is a circumstance, that has a particular tendency to increase the danger of the accident. In many cases, we see injuries of this description followed by violent and extensive inflammation, abscesses and mortification, fever, delirium, and death. When the patient is much advanced in years, is much debilitated, or of an unhealthy irritable constitution, compound luxations, especially if attended with much contusion and other injury of the soft parts, and wrongly treated, very often have a fatal termination. This, however, is not the general event of compound dislocations, and whatever may have happened in former times, we now know, that, in the present improved state of surgery, these accidents mostly admit of cure. This statement may be made, without any censure being cast upon every instance of amputation performed in such cases. I know, that this operation is sometimes indispensable directly after the accident, and I am equally aware, that it may become necessary in a future stage, when extensive abscesses, or sloughing, joined with threatening constitutional symptoms, have taken place. My only design is to recommend the endeavour to cure the generality of compound luxations. But, if a case were to present itself, attended with serious contusion and laceration of the soft parts, I should be as earnest an advocate for amputation as any surgeon.

Mr. Hammick, surgeon to the Royal Naval Hospital, Plymouth, in speaking of compound dislocations of the ankle, advises amputation, "where the lower heads of the tibia and fibula are very much shattered; where, together with the compound dislocation of these bones, some of the tarsal bones are displaced and injured; where any large vessels are divided, and cannot be secured without extensive enlargement of the wound, and disturbance of the soft parts; where the common integuments, with the neighbouring tendons and muscles are considerably torn; where the protruded tibia cannot by any means be reduced; and where the constitution is enfeebled at the time of the accident, and not likely to endure pain, discharge, and length of confinement." (*A. Cooper's Surg. Essays, Part 2, p. 146.*) Perhaps, as general remarks, these may not be inaccurate; but, there are exceptions to them. Thus, we find in Mr. A. Cooper's publication several cases, in which compound dislocations of the ankle terminated well, notwithstanding the displacement and removal of the astragalus, other instances of which kind of success are to be found in the records of surgery. (See *Laumonier, in Fournier, Méd. éclairée; Percy, in Journ. de Med. continué Nov. 1811, p. 348.*) However, if the ends of the tibia and tarsal bones, especially the astragalus and os calcis are broken, the operation of

amputation is recommended on high authority. (*A. Cooper's Surg. Essays, Part 2, p. 181.*) But, with regard to the division of large blood-vessels, Mr. A. Cooper states, that he would not at once proceed to amputation on that account. "The case from Mr. Sandford of Worcester, sent me by Mr. Carden, clearly shows, that the division of the anterior tibial artery does not, if it be well secured, prevent the patient's recovery. I also once saw a compound fracture, close to the ankle-joint, accompanied by a division of that artery; and, although the patient was in the hospital, and a brewer's servant, who possessed the worst constitution to struggle against severe injuries, yet this man recovered without amputation." Nor in Mr. A. Cooper's opinion, would all hope be precluded, even if the posterior tibial artery were injured. (*Voc. cit. p. 186.*) For the method of securing these vessels, see *Arteries*.

The following are the circumstances, which Mr. A. Cooper has known to give rise to the necessity for amputation in compound dislocations of the ankle. 1. The advanced age of the patient. 2. A very extensive lacerated wound. 3. Difficulty of reducing the ends of the bones he considers rather as a reason for sawing them off, than for amputation. 4. The extremely shattered state of the bones. 5. Dislocations of the tibia outwards cause greater injury of the bones and soft parts, than those inwards, and more frequently require amputation. 6. Sometimes the bone cannot be kept reduced, owing to the tibia in the dislocation outwards being obliquely fractured. 7. Division of a large blood-vessel, attended with extensive wound of the soft parts. 8. Mortification. 9. Excessive contusion. 10. Extensive suppuration. 11. Necrosis, where the sequestra do not admit of removal. 12. Very great and permanent deformity of the foot. 13. When tetanus comes on, Mr. A. Cooper does not approve of the operation.

The treatment of a compound dislocation requires the reduction to be effected without delay, and with as little violence and disturbance as possible. If any difficulty of reduction should arise from the bone being girt by the integuments, the opening in them should be dilated with a scalpel. The limb is then to be placed in splints, with the necessary pads, eighteen-tailed bandage, &c. Mr. A. Cooper judiciously recommends the portions of this bandage not to be sewed together, "but passed under the leg, so that one piece may be removed when it becomes stiff;" and by fixing another to its end, before it is withdrawn, the fresh piece may be applied, without any disturbance of the limb. (*Surg. Essays, Part 2, p. 120.*) The wound is to be freed from any dirt, clots of blood, or other extraneous matter, and its lips are to be accurately brought together with strips of adhesive plaster. Mr. A. Cooper considers lint dipped in the blood, which oozes out, the best kind of first dressing. The joint is to be covered with linen kept constantly wet with the liquor plumbi acetatis dilutus, or with what is better,

spirit of wine and water; the bandage is to be loosely laid down, and the splints fastened on the limb with their proper straps, or pieces of tape, and the limb is to be kept perfectly at rest in an eligible posture. The patient, if strong and young, is to be bled. This last practice may be more freely adopted in the country, than in London, or large hospitals. An anodyne, the first night, or two, will be highly proper. Saline draughts, antimonial, and a low regimen, are also indicated during the first few days of the symptomatic fever, which commonly follows to serious an accident.

According to Mr. A. Cooper, purgatives should be used with the utmost caution; "for, (says he,) there cannot be a worse practice, when a limb has been placed in a good position, and adhesion is proceeding, than to disturb the processes of nature by the frequent changes of position, which purges produce; and I am quite sure, that, in cases of compound fracture, I have seen patients destroyed by their frequent administration. That which is to be done by bleeding and emptying the bowels, should be effected within an hour, or two, after the accident, before the adhesive inflammation arises." (*Surgical Essays, Part 2, p. 121.*) Here the fracture bed, invented by Mr. Earle, would allow purgatives to be used, without any disturbance of the limb.

If the case takes a favourable course, the constitutional fever will not be excessive, nor will the pain and inflammation of the limb be immoderate. Sometimes, the wound unites, more or less, without suppuration; a circumstance particularly desirable, as tending more than any thing else to lessen the danger, by changing the case, as it were, from a compound into a simple one. In other cases, the wound is not united; but the inflammation and suppuration are not violent, nor extensive; the constitution is not dangerously disturbed; and hopes of ultimate success may be reasonably entertained. When the wound is disposed to heal favourably, adhesive plaster, with or without lint, or a pledget of soft soap cerate, is the best dressing. In other instances, while the suppuration is copious, and the parts are tense and painful, emollient poultices are the most eligible.

When the symptomatic fever, and first inflammatory symptoms, are over, and much discharge prevails, attended with marks of approaching weakness, the patient is to be allowed more food, and directed to take bark, cordials, porter, wine, &c. If his nights are restless, he must have opiates; if he sweats profusely, sulphuric acid; and, in short, all such medicines, as his particular complaints may require, are to be prescribed.

When the inflammation of a compound dislocation is violent, or extensive, general bleeding, the application of leeches, and the use of fomentations, and poultices, are the most likely means of lessening the mischief. Yet, it is only in strong habits, that venesection

to any extent can be prudently practised in large cities, or crowded hospitals.

The following are the instructions, delivered by Mr. A. Cooper, on the subject of dressings. "If the patient complain of considerable pain, in the part in four or five days, the bandage may be raised to examine the wound; and, if there be much inflammation, a corner of the lint (or other dressing) should be lifted from the wound, to give vent to any matter, which may have formed; but, this ought to be done with great circumspection, as there is danger of disturbing the adhesive process, if that be proceeding without suppuration. By this local treatment, it will every now and then happen, that the wound will be closed by adhesion; but, if in a few days it be not, and suppuration take place, the matter, should have an opportunity of escaping; and the lint being removed, simple dressings should be applied. After a week, or ten days, if there be suppuration, with much surrounding inflammation, poultices should be applied upon the wound, leeches in its neighbourhood, and upon the limb at a distance, the evaporating lotion should still be employed; but, as soon as the inflammation is lessened, the poultices should be discontinued." (*Surgical Essays, Part 2, p. 121.*)

In certain examples, the most skilful treatment is unavailing. The joint and limb become affected with considerable pain and swelling; the fever runs high; delirium comes on; and the patient may even perish from the violence of the first symptoms, the limb being generally at the same time attacked by gangrene. If these first dangers are avoided, the wound may yet not heal favourably; the inflammation may be considerable, or of an erysipelatous nature; large abscesses under the fasciæ may be formed; the bones may be affected with necrosis; and the hectic symptoms, and sinking state of the patient, may make the only chance of recovery depend upon amputation. But, even this operation is sometimes deferred till too late, and the patient must be left to his miserable fate.

Whoever gives the smallest reflection to the nature of compound fractures, will perceive, that it is often a matter of the highest importance, to make a right decision at the very beginning, whether amputation should be immediately done, or whether an attempt to save the limb ought to be made. In some instances, the patient's sole chance depends upon the operation being performed at once, without the least delay, and the opportunity of doing it never returns. The surgeon should take off the limb as soon as he has seen the nature of the injury, and not wait till a general tendency to swelling and gangrene has spread through the member, and every action in the system is disturbed. Amputation, under these circumstances, is undoubtedly done with a very diminished chance of success; and, until certain facts were adduced by Baron Larrey, Mr. Lawrence, Mr. A. C. Hutchinson, and others, was

of late years altogether prohibited. (See *Amputation and Mortification*.)

But besides this first critical period, the surgeon often has to exercise a nice degree of judgment in a future stage of the case; I mean, when the suppuration is copious, the wound open, the bones carious, and the health impaired. Here the practitioner may sometimes err, in taking off a limb that might be saved; or, he may commit a worse fault, and make the patient lose his life, in a fruitless attempt to save the member. No precepts can form the right practitioner in this delicate part of surgery; genius alone cannot do it; the opportunity of making observations, and the talent of profiting by them, are here the things which make the consummate surgeon.

It should ever be recollected, in regard to bad compound dislocations, that in young subjects, and in a salubrious air, many cases will do well, which in old persons, and in the polluted atmosphere of London, and crowded hospitals, would be fatal without amputation.

The constitutions of some individuals are so irritable, that whether an attempt be made to save the limb, or amputation be at once performed, the case has a rapid and fatal termination. According to Mr. A. Cooper, persons who are much loaded with fat, "are generally very irritable, and bear important accidents very ill; indeed, says he, they generally die, whichever plan of treatment be pursued." However, he adds, that such corpulent people as take a great deal of exercise, form exceptions to the foregoing remark." (*Surgical Essays, Part 2, p. 195*.)

There is a practice, in regard to compound dislocations, which, I think ought at all events to be adopted only in a very few cases; I mean the plan of sawing off the head of the luxated bone. According to L  veill  , this method is recommended by Hippocrates as a means of accelerating and perfecting the cure. (*Nouvelle Doctrine Chirurgicale, Tom. 2, p. 44*.) However, it seems not to have done sufficient good, in ancient times, to obtain a lasting reputation. In fact, when it was mentioned by the late Mr. Gooch, it had sunk into such oblivion, that it was received as an entirely new proposal. "Compound luxations (says this author) are of a more dangerous nature, than compound fractures, for very plain reasons; but, if a surgeon should judge it advisable to attempt saving a limb under such threatening circumstances, I am inclined to think, from what I have observed, he will be more likely to succeed, by sawing off the head of the bone, especially if it has long been quite out and exposed to the air."

Mr. Gooch afterward takes notice of a case in which Mr. Cooper of Bangay sawed off the heads of the tibia and fibula, and preserved the limb, the patient being able to walk and work for his bread for many years afterward. Other examples are also briefly mentioned, in which the lower head of the radius was sawn off, and the head of the second bone of the thumb.

The late Mr. Hey of Leeds, was induced to make trial of this plan in a compound luxation of the ankle. The example, however, which he published, is decidedly highly unfavorable to the practice, as the following passage will show: "I was in hopes, that this patient would have been able to walk stoutly; but, in this, I was disappointed. He walked indeed without a crutch; but, his gait was slow, his leg remaining weak, and his toes turning outwards, which rather surprised me, as his leg was very straight, when I ceased attending him."

Mr. Hey did not recite this case, with the view of recommending a similar practice in all cases of this accident; for, he had not always adopted it, nor was he of opinion, that the same mode of treatment, whether by replacing the bones, sawing off their extremities, or amputating the limb, ought to be universally practised. When the laceration of the capsular ligament and integuments is not greater, than is sufficient to permit the head of the tibia to pass through them; and when, at the same time, the joint, or contiguous parts, have suffered no other injury; Mr. Hey recommends the replacing of the bone, and an union of the integuments by suture, with the treatment adapted to wounds of the joints.—(*Practical Observations in Surgery, Chap. 11, Edit. 2.*)

That in a few cases, recorded by Mr. Gooch, and Mr. Hey, the patients recovered with a new sort of joint, only proves to my mind, the great resources and activity of nature, and her occasional triumph over the opposition she meets with from bad and injudicious surgery. A limb so treated, must ever afterward be shorter than its fellow, and consequently the patient be more or less a cripple. We have seen, that, in the only instance, published by Mr. Hey, considerable deformity was the consequence of the practice. I cannot help adding my belief, that this gentleman would have experienced more success in the treatment of compound dislocations, had he relinquished the objectionable method of sewing up the wound. In such accidents, every kind of irritation should be avoided as much as possible, and that the wound may be conveniently closed with sticking plaster, the observation of numerous cases in St. Bartholomew's Hospital has perfectly convinced me. In this munificent institution, under the disadvantage of the air of London, and an hospital, compound luxations used, at the period when I was an apprentice there, to be treated with marked success; and, I feel warranted in ascribing the circumstance to the mode of treatment, which was conducted on the principles explained in this section of the dictionary.

The most ingenious arguments, which have yet been urged in behalf of the practice of sawing off the ends of the bones, in compound dislocations of the ankle, are those recently published by Mr. A. Cooper. However, he does not advise the plan, without restrictions. If the dislocation (says

he) can be easily reduced, without sawing off the end of the bone; if it be not too obliquely broken to remain firmly upon the astragalus after being reduced; if the end of the bone be not shattered, for then the small loose pieces of bone should be removed, and the surface of the bone be smoothed by the saw; if the patient be not excessively irritable, and the muscles, affected with violent spasms, impeding reduction, and causing a displacement of the bones after they have been reduced; Mr. A. Cooper advises the immediate reduction of the parts, and uniting the wound by adhesion. In the opposite circumstances, rather than amputate the limb, he would saw off the ends of the bones. (*Surgical Essays, Part 1, p. 154.*)

The only case, in which the plan of sawing off the head of the bone can be at all proper, is when a compound dislocation cannot be reduced, notwithstanding the enlargement of the wound in the skin, and every other possible means. There is no other mode of preventing the formidable symptoms, which would ensue, were the bone left in a state of protrusion through the integuments; nor is there any better way of alleviating such symptoms after they have actually begun. M. Roux gives much praise to the English surgeons for the judicious boldness, which they have evinced in cases of this description. Although Fabricius Hildanus, Ferrand, Desault, Laumonier, and several other French surgeons, have, like many British practitioners, ventured to remove the whole of the astragalus, when this bone was totally separated from the scaphoides, and protruded, in compound luxations, yet M. Roux acknowledges, that the bold practice of sawing off the lower end of the humerus, the lower end of the radius, the lower end of the tibia, and also of the fibula, at the same time, originated with, and was first executed by English surgeons. (*Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise, p. 208—209.*)

DISLOCATIONS OF THE LOWER JAW.

The lower jaw can only be luxated forward and either one, or both of its condyles may become displaced in this direction. Every dislocation, except that forward, is rendered impossible by the formation of the parts. The lower jaw cannot even be dislocated forward, unless the mouth, just before the occurrence of the accident, be very much open. Whenever the chin is considerably depressed, the condyles slide from behind forward, under the transverse root of the zygomatic processes. The cartilaginous cap, which envelopes the condyles, and follows them in all their motions, still affords them an articular cavity; but, the depression of the bone continuing, the ligaments give way, the condyles glide before the *eminentie articulares*, and slip under the zygomatic arches. Hence, a dislocation mostly happens, while the patient is laughing, gaping, &c. A blow on the jaw,

when the mouth is wide open, may easily cause the accident. The case has occasionally arisen from the exercise of great force in drawing out the teeth. Whenever the jaw has once been dislocated, the same causes more easily reproduce the occurrence. In certain individuals, the ligaments are so loose, and the muscles so weak, that a dislocation is produced by any slight attempt to yawn, laugh, or (as Lamotte has observed) to bite any substance, which is rather large. (*Levéillé, Nouvelle Doctrine Chirurgicale, Tom. 2. p. 54.*) There have been persons, who could scarcely ever laugh heartily, without their lower jaws being luxated. But, of all the causes of this occurrence, yawning alone, even without the combination of any external force, is by far the most common.

When the jaw is depressed, and its angles, to the external sides of which the masseters are attached, are carried upwards and backwards, if these muscles contract, the greater part of their force is employed to bring the condyles into the zygomatic depression. (*Boyer.*)

Dislocations of the lower jaw are attended with a great deal of pain, which Boyer imputes to the pressure produced by the condyles on the deep-seated temporal nerves, and those going to the masseters, which nerves pass before the roots of the zygomatic process. The mouth is wide open, and cannot be shut. It is more open in recent dislocations, than in those, which have continued for some time. An empty space is felt before the ear, in the natural situation of the condyles. The coronoid process forms under the cheek bone a prominence, which may be felt through the cheek, or from within the mouth. The cheeks and temples are flattened by the lengthening of the temporal, masseter, and buccinator muscles. The saliva flows in large quantities from the mouth, the secretion of which fluid is greatly increased by the irritation of the air. The arch, formed by the teeth of the lower jaw, is situated more forward than that formed by the teeth of the upper jaw. During the first five days after the accident the patient can neither speak, nor swallow. (*Boyer.*) When only one condyle is dislocated, the mouth is distorted, and turned towards the opposite side, while the fellow-teeth of the jaws do not correspond. However, Mr. Hey asserts, that frequently the position of the chin is not perceptibly altered. (*Practical Observations, p. 322.*)

When the accident has remained unreduced for several days or weeks, the symptoms are not so well marked. In such instances, the chin becomes gradually approximated to the upper jaw; the patient recovers by degrees the faculty of speaking and swallowing; but, he stammers, and the saliva dribbles from his mouth. The sufferings, induced by a dislocated jaw, are certainly great enough to be sometimes fatal, if the case continue unrectified; but, we are not to believe Hippocrates, when he

positively declares the accident mortal, if not reduced before the tenth day.

Monteggia attended a man, two months after such a luxation, which had not been understood, and Fabricius ab Aquapendente assures us that he had never seen the prognostic of Hippocrates verified, though he had had many patients of this sort under his care. (*Leveillé, Nouvelle Doctrine Chir. T. 2. p. 58.*)

Dislocations of the lower jaw are to be reduced in the following manner: The surgeon is first to wrap some linen round his thumbs to keep them from being hurt by the patient's teeth, and then introduce them into the mouth, as far as possible on the grinding teeth. At the same time, he is to place his fingers under the chin and base of the jaw, and while he depresses the molares with his thumbs, he raises the chin with his fingers, by which means the condyles become disengaged from their situation under the zygomas; at which instant the muscles draw those parts so rapidly back into the articular cavities again, that the surgeon's thumbs might sometimes be hurt, did he not immediately move them outward between the cheek and the jaw.

The reduction being accomplished, a fresh displacement is to be prevented by applying a four-tailed bandage, as recommended for the fractured jaw. The patient should for some time avoid eating food which requires much mastication.

The ancients used to place two pieces of stick between the grinding teeth, and, while they used these as levers to depress the back part of the bone, they raised the chin by means of a bandage. John de Vigo has described this method from Salicetus, Lanfranc, and Guido di Cauliaco; but, it is not preferable to the modern plan, in regard to efficacy; and it has the disadvantage of exposing the teeth to injury.

DISLOCATIONS OF THE VERTEBRÆ.

The large surfaces, with which these bones support each other; the number and thickness of their ligaments; the strength of their muscles; the little degree of motion which each vertebra naturally has; and the vertical direction of the articular processes; make dislocations of the dorsal and lumbar vertebræ impossible, unless there be also a fracture of the above-mentioned processes. Of these cases I shall merely remark, that they can only result from immense violence; that the symptoms would be an irregularity in the disposition of the spinous processes, retention or incontinence of the urine and feces, paralysis and a motionless state of the lower extremities, the effects of the pressure, or other injury, to which the spinal marrow would be subjected. Similar symptoms may also arise, when the spinal marrow has merely undergone a violent concussion, without any fracture or dislocation whatever; and it is certain, that most of the cases mentioned by authors as dislocations of the lumbar and

dorsal vertebræ, have only been concussions of the spinal marrow, or fractures of such bones.

The cervical vertebræ, however, not having such extensive articular surfaces, and having more motion, are occasionally luxated. The dislocation of the head from the first vertebra, and of the first vertebræ from the second, particularly the last accident, is the most common; but luxations of the cervical vertebra lower down, though very rare, are possible. Indeed, according to Boyer, many examples have happened, in which one of the inferior oblique, or articular processes of a cervical vertebra has been dislocated, so as to cause a permanent inclination of the neck towards the side opposite to that of the displacement. (*Traité des Mal. Chir. T. 4, p. 114.*)

Whether the case, published by Mr. C. Bell, under the name of a subluxation of the spine, ought to be received as an unequivocal specimen of a displacement of the last cervical from the first dorsal vertebra, I cannot pretend to determine. This author speaks of an evident loosening between these two bones; of a considerable space between them; of the destruction of the intervertebral substance; and of an immense quantity of pus around the injured part of the spine; as circumstances seen in the dissection. "On the backpart, the pus had extended under the scapula; and on the forepart was bounded by the œsophagus," and, in the spinal canal, it had descended through the whole length of the sheath to the cauda epuina. (*C. Bell, Surg. Obs. Vol. 1, p. 148.*)

DISLOCATION OF THE HEAD FROM THE FIRST VERTEBRÆ, OR ATLAS.

The os occipitis, and first cervical vertebra are so firmly connected by ligaments, that there is no instance of their being luxated from an external cause, and, were the accident to happen, it would immediately prove fatal by the unavoidable compression and injury of the spinal marrow.

Five examples of displacement of the atlas by disease are in the Museum at Leyden, and are described by Sandifort. Boyer has seen one at la Charité; and a very interesting description of a similar case, illustrated by engravings, has been recently published by Schupke. (*De Luxatione Spontanea Atlantidis et Epistrophei, Atto. Berol. 1816.*) In this tract is collected from the writings of J. P. Frank, (*Delect. Opusc. Vol. 5.*) from those of Reil, (*Feiberlehre, B. 2, § 102;*) and of Rust, &c. an exact detail of the symptoms of the disease; an important topic on which Boyer confesses his inability to give any information. These spontaneous displacements of the atlas may depend upon caries and scrophulous disease of its articular surfaces, or upon an exostosis of its transverse process, or a similar tumour growing from the neighbouring portion of the os occipitis, or petrous portion of the temporal bone. By these causes, the anterior, or posterior

arch, or one of the sides of the atlas, has been made to intercept a third, the half, and even two-thirds of the diameter of the foramen magnum. Notwithstanding the very remarkable constriction of the medulla spinalis, thus occasioned, it is noticed by Boyer, that life may be carried on, and the nutritive functions performed sufficiently well to afford time enough either for the exostoses to attain a large size, or for the ankylosis, binding together the head and most of the cervical vertebræ, to acquire great solidity. According to the same author, the atlas is never found free and distinct, when thus displaced, but is confounded at least with the os occipitis, and mostly with five or six of the subjacent vertebræ. And, another interesting fact is, that, in cases of this description, the joint between the atlas and occiput is never the only one, which is displaced and deformed, unless the disease be very slightly advanced; for, the articulation of the processus dentatus with the atlas, and sometimes that of the point of the same process with the occiput, are considerably affected. Sometimes, the processus dentatus and the occiput retain their natural position with respect to each other, and the atlas alone seems to be displaced between them. Sometimes the second vertebra is out of its place with respect to the os occipitis in the same direction as the atlas, but not in quite so great a degree. Lastly, in some other instances, the two vertebræ are twisted in opposite directions, as, for instance, one to the left, the other to the right; or vice versa. In one of the cases recorded by Sandifort, this kind of lateral displacement in opposite directions was so extensive, that an interspace, only six lines in breadth, was left between their approximated annular margins. An instance was seen by Duverney, where the displacement of the two vertebræ was from before backward, and where the processus dentatus was approximated to the posterior arch of the atlas to the extent of two-thirds of the annular opening in this vertebra. In these cases, nothing can be more obvious, than that there must be a destruction, or at all events a thoroughly diseased state, of the ligaments between the atlas and dentatus, and of those connecting the dental process to the occiput. (*Boyer, Vol. cit. p. 105.*)

As for the treatment of the preceding forms of disease, experience has hitherto furnished little satisfactory knowledge. But, as an analogy is seen between these cases, and the strophulous and carious affections of other joints, blisters, setons, and issues have been proposed and tried. Rust found these remedies only capable of retarding the progress of the disease, and of producing an abatement of the symptoms. The pain often reaching from the back of the head to the forehead, was rendered less severe; and the difficulty of swallowing was considerably lessened. But, the means here specified were not found adequate to arrest the morbid change in the bones. However, Rust thinks, that greater benefit might be expect-

ed, if a case were to present itself arising altogether from a local cause, without its origin being connected with constitutional disease. (*Salzburger, Med. Chin. Zeitung Jahrgang. 1813, B. 3, p. 108.*)

DISLOCATIONS OF THE FIRST CERVICAL VERTEBRA FROM THE SECOND.

The rotatory motion of the head is chiefly performed by the first vertebra moving on the second. When this motion is forced beyond its proper limits, the ligaments which tie the processus dentatus to the edge of the foramen magnum are torn, and, supposing the head to be forced from the left to the right, the left side of the body of the vertebra is carried before its corresponding articulating surface, while the right side falls behind its corresponding surface. Sometimes the processus dentatus, whose ligaments are ruptured, quits the foramen formed for it by the transverse ligament and the anterior arch of the first vertebra, and presses on the medulla oblongata. But, according to Boyer, the processus dentatus may be displaced in two ways: 1st, It may be carried directly backwards, the transverse and other ligaments being broken. This mode of displacement Boyer considers as the most difficult and uncommon, as it can hardly take place, except from a fall from a great height upon the back of the head, while the spine is bent forwards. (*Traité des Mal. Chir. T. 4, p. 109.*) However, the accident may happen in another manner, as was the case in Mr. C. Bell's instance, where the misfortune occurred from a fall with the chin upon the curb-stone. (*Surg. Obs. Vol. 1. p. 150.*) 2dly, In a violent rotation, in which the face is carried sideways beyond the proper limits, the lateral and accessory ligaments of the processus dentatus may be stretched and twisted spirally round this process. The force operates entirely upon them, and not at all upon the transverse ligament. Now when the lateral and accessory ligaments of the processus dentatus have given way, and an effort to incline the head to one side is kept up, one of the sides of the space, bounded by the transverse ligament, may present itself near the point of the processus dentatus, which may then pass below the transverse ligament without rupturing it.

In children, where the processus dentatus is not fully developed, and the ligaments are weaker than in the adult, a perpendicular impulse may break the lateral and accessory ligaments, and then force the processus dentatus under the transverse ligament, without rupturing this latter part; as Boyer conceives must have been the case in the child, which J. L. Petit mentions as having been instantaneously killed by being lifted up by the head.

Lastly, it is asserted, that, when the transverse, lateral, and other ligaments are capable of making very great resistance to force, which tends to rupture them all, and to throw the processus dentatus directly backwards, this process, if at all more slender

than common, may be broken near its base, and the lateral articulations between the two first vertebræ be instantly destroyed. (Boyer, *Vol. cit.* p. 110.)

Patients can hardly be expected to survive mischief of this kind in so high a situation; when the transverse ligament is broken, and the processus dentatus is thrown directly backward against the medulla oblongata, the effect must be instant death, as happened in the case lately recorded by Mr. C. Bell. (*Surg. Obs. Vol. 1, p. 150.*)

According to surgical writers, the causes which may produce this formidable accident, are various: a fall on the head from a high place; the fall of a heavy body against the back of the neck; a violent blow; a forcible twist of the neck; tumbling; standing upon the head; the rash custom of lifting children up by the head, &c. Louis found that the first vertebra was dislocated from the second in the malefactors hanged at Lyons, at which place, the executioner used to give a sudden twist to the body, at the moment of its suspension, and then bear with all his weight upon it. Under such circumstances, Boyer conceives that the processus dentatus would pass under the transverse ligament, without this ligament being ruptured.

Dislocations of the cervical vertebræ are said not to be always fatal, as when they occur at the third, fourth, fifth, or sixth of these bones, and only one articular process is luxated. In these instances, the vertebral canal is not so much lessened as to compress the spinal marrow, and occasion immediate death.

With regard to the prognosis and treatment of all luxations in which the processus dentatus is displaced, the reader need only hear, that such cases are immediately fatal. Mistaken notions have been entertained upon this point, in consequence of particular dislocations of the neck having been successfully treated.

A mother brought her child to Desault, with its neck bent, and its chin turned towards the right shoulder. The accident had been a consequence of the head having been fixed on the ground, while the feet were up in the air. A surgeon happened to be with Desault at the time, and they agreed to make an attempt to reduce the luxation, and to apprise the mother, that though the child might be cured, there was a possibility of its perishing under their hands. Being permitted to do what they judged proper, they fixed the shoulders, and the head was gently raised, and gradually turned into its natural position. The mother was rewarded for her courageous resignation; the child could now move freely; the pain ceased, and a considerable swelling in the situation of the luxation alone remained, and it was dispersed by the application of emollient poultices. (Levéillé, *Nouvelle Doctrine Chir. T. 2, p. 62.*)

Another alleged instance of the reduction of a dislocation of the neck is also recorded by Dr. Settin, in vol. 1 of Schmucker's *Vermischte Chirurgische Schriften*.

However, both in this case, and that related of Desault, there can now be little, or no doubt, that the accident was not a dislocation of the dentata from the atlas, but only a luxation of one of the oblique processes of one of the cervical vertebræ lower down. Whenever the processus dentatus is suddenly displaced, or fractured, the effects on the medulla spinalis are inevitably fatal. For more information respecting dislocations of the vertebræ, consult T. E. Schmidt, *De Luxatione Nuchæ*, Haller, *Disp. Chir. 2. 351, Tab. 1747*. S. T. Soemmering, *Bemerkungen über Verrenkung und Bruch des Rückgraths*, 8vo. Berlin, 1793. Boyer, *Traité de Mal. Chir. T. 4, p. 100, &c.* 8vo. Paris, 1814. A. E. Schupke, *De Luxatione Spontanea Atlantidis et Epistrophei*, 4to. Berol. 1816. C. Bell, *Surgical Obs. Vol. 1, p. 145, 149, &c.* 8vo. Lond. 1816.

DISLOCATIONS OF THE CLAVICLE.

These are much less common, than fractures, which are said to occur six times more frequently.

The clavicle may be luxated at its sternal extremity, forwards, backwards, and upwards, but never downwards, on account of the situation of the cartilage of the first rib. The luxation forward is the most frequent, and almost the only one ever met with. It may arise from the other end of the clavicle being forced very much backward. Dislocations backwards and upwards are very unusual. To cause the first sort of accident, the shoulder must be violently driven forwards, and at the same time depressed with great force. The dislocation backwards is more rare, than that upwards.

If the dislocation be forwards, a hard circumscribed tumour is felt, or even seen, on the front and upper part of the sternum. When the shoulder is carried forward and outward, this tumour disappears, and previously there was a vacancy where the head of the clavicle ought to be.

When the luxation is upwards, the distance between the sternal ends of the clavicles is diminished.

When the dislocation is backwards, there is a depression where the end of the clavicle ought to be, and the head of the bone forms a projection at the front and lower part of the neck, which, as J. L. Petit remarks, may compress the trachea, œsophagus, jugular vein, carotid artery, and nerves. The head is inclined towards the side, on which the accident itself is situated.

In reducing these dislocations of the sternal end of the clavicle, we are to make a lever of the arm, by means of which the shoulder is brought outwards; and when thus brought outwards, it is to be pushed forwards, if the dislocation be in that direction; backwards, if the dislocation be behind; and upwards, if the dislocation be above.

It is as difficult to keep the bone reduced, as it is easy to reduce it, so smooth and oblique are the articular surfaces.

The same position of the arm, and the

same apparatus, as in fractures of the clavicle, are to be employed. The end of the clavicle, however, can never be kept from rising a little, and this would be the case even were the tourniquet used, which was proposed by Brador, for making pressure on the end of the bone.

The dislocation of the capsular end of the clavicle from the acromion is much less common. The luxation upwards is almost the only one that ever occurs. It is possible, however, for the accident to take place downwards, and for the end of the clavicle to glide under the acromion. The rarity of dislocations of the capsular end of the clavicle, is owing to the strength of the ligaments tying the clavicle and acromion together.

A fall on the top of the shoulder may cause the dislocation upwards. The scapular end of the clavicle then slides upwards on the acromion, and the shoulder is drawn inwards by the muscles which approximate the arm to the body. The violent action of the trapezius muscle, in pulling upward the clavicle, may tend to produce the accident. Pain at the top of the shoulder, and a projection at the end of the clavicle, under the skin covering the acromion, are symptoms, indicating what has happened. The patient also inclines his head to the affected side, and avoids moving his arm or shoulder.

This dislocation is reduced by carrying the shoulder outwards, putting a cushion in the axilla, and applying Desault's bandage for fractures of the clavicle, (*See Fractures*), making the turns ascend from the elbow to the shoulder, so as to press the luxated end of the bone downward, and keep it in its due situation, at the same time that the elbow is confined close to the side, and supported in a sling, by which means the shoulder will be kept raised and inclined outwards. This plan, which is advised by Boyer, is more efficient than the common practice, which consists in applying a compress, the figure of 8 bandage, and supporting the arm in a sling. However, the exact maintenance of the reduction by any apparatus whatever, is found to be a matter of the greatest difficulty, though it is agreeable to know, that notwithstanding this disadvantage, the cases always have a favourable termination. In the course of my time, I have seen several cases in proof of this statement, and one example was shown me last summer by Mr. Vincent, in St. Bartholomew's Hospital.

DISLOCATIONS OF THE OS BRACHII.

Nature, which varies according to the necessities of different animals, the number of their joints, has also been provident enough to vary the structure of these parts, according to the use of the different portions of their economy. To great moveableness some unite considerable solidity; for instance, the vertebral column. Others are very strong, but only admit of a slight yielding motion, as we observe in the carpus, tarsus, &c. Lastly, other joints admit of

a great latitude of motion; but their strength is easily overpowered by the action of external bodies. Such are, in man, the shoulder-joint, and that between the sternum and clavicle.

The last kinds of articulation are particularly subject to dislocation, and, of all, not one is so often luxated as the shoulder-joint. Bichat mentions, that it appears, from a comparative table, that in some years, this accident, at the Hôtel-Dieu, has been as frequent, and even more so, than dislocations of all the other bones taken collectively.

Here every thing seems to facilitate the escape of the bone from its natural cavity. An oval shallow cavity, surrounded by a margin of little thickness, receives a semi-spherical head, which is twice as broad as the cavity in the perpendicular direction, and three times as extensive from before backward. With respect to the ligaments, the joint is only strengthened by a mere capsule, which is thin below, where nothing opposes a dislocation; but thicker above, where the acromion, coracoid process, and triangular ligament, form an almost insurmountable obstacle to such an accident. With regard to the muscles, and motions of this joint, strong and numerous fasciculi surround the articular surfaces, make them easily move in all directions, and pushing the head of the os brachii against the different points of the capsule, distend this ligamentous bag, and when their power exceeds the resistance, actually lacerate it. As for external bodies, what bone is more exposed than the os brachii, to the effect of their force?

Thus subjected to the influence of these predisposing causes, the os brachii would be in continual danger of being dislocated, if the scapula, which is as moveable as itself, did not furnish a point of support for it, by accompanying all its motions. This point of support accommodates itself to the variations in the position of the head of the os brachii, so that to the moveableness of the articular surfaces, their strength is, in a great measure owing.

The shoulder-joint, which is very liable to luxations in a general sense, is not equally so at all points. There are some, where a dislocation cannot occur; there are others, where, though possibly such an accident has never been observed. Hence, before examining the mechanism of dislocations of this joint, it is essential to determine with precision the directions, in which they may take place. Here, indeed, authors differ in a very singular manner. Sometimes, they employ different terms to express the same thing; and sometimes, the same words to signify different things. Invariably agreed about certain kinds of dislocations, they entertain opposite sentiments concerning others; and, in the midst of these differences, the perplexed surgeon often cannot decide on what basis to found his practice.

Several former writers speak of four kinds

of dislocations of the shoulder; many of three; some acknowledge only two: while others allow the possibility of only one kind.

By those, who enumerated the different directions, in which the bone might be luxated, four cases were particularly noticed. The dislocations were termed *upward, downward, forward, and backward*. Such was the opinion of the predecessors of Hippocrates, who sufficiently demonstrates its inaccuracy. Others divided dislocations of the shoulder into such as take place *downward, upward, outward, and forward*. This division is adopted by Galen, who, however, only cites an example of the luxation forward, and does not illustrate what he means by dislocations upward, and inward.

The second class of writers, among whom was Oribasius, distinguished dislocations into those which occur *downward, forward, and backward*. Sometimes, they named the luxations *downward, outward, and inward*. Paul of Ægina followed this plan, and, no doubt, his meaning is the same as that of Oribasius, only expressed in different terms. Sometimes, they called the dislocations *downward, forward, and upward*. Albucasis did so, and thought the latter case exceedingly uncommon.

The third set believed, that when the head of the os brachii was displaced, it could be carried only *downward into the armpit*, a very common case; or *forward*, an accident less frequent. Celsus is almost the only one, who has established this difference: he remarks, *Humerus modo in aliam exidit, modo in partem priorem*.

Lastly, the fourth body of writers only believed in the dislocation downward; which was the sentiment of Hippocrates, who had seen no other sort of case in his practice. *At verò humerus inferiorem in partem exidit; aliam in partem excidere non auidi*.

The moderns borrowed from the ancients their divisions of dislocations of the shoulder-joint, and, at first, like their predecessors, they only determined in a vague manner the precise situations of the head of the bone. However, they afterward fixed it with more determination, in proportion as they became enlightened by anatomy; and, in particular, took notice of the essential difference between primitive and consecutive luxations.

Petit admits four kinds of dislocations. 1. Downward on the inferior costa of the scapula, very rarely met with. 2. Outward, under the spine of this bone; a case, which as a primitive one, can only occur with difficulty. 3. Inward, into the armpit. 4. Forward, between the coracoid process and the clavicle. Heister, like this eminent practitioner, acknowledged four dislocations; but with a difference both of expression and meaning. One is downward, in the axilla; one forward, under the great pectoral muscle; another backward, under the scapula, and a fourth outward, under the spine of this bone. According to Duverney,

primitive luxations never occur in any direction but downward; the others being all the effect of muscular action.

DIVISION ADOPTED BY DESAULT.

In the midst of these very confused ways of viewing a very simple subject, Desault judged it necessary, in order to acquire determinate ideas, to divide dislocations of the humerus into *primitive*, which are the sudden effect of external violence, and into *consecutive*, which follow the first, by the influence of causes presently to be explained.

Let the oval surface of the glenoid cavity be included within four lines; one representing its upper edge; another its lower; a third its inner edge; and a fourth its external one.

It is manifest, that the head of the humerus cannot be displaced towards the upper edge. There, are situated the acromion and coracoid process, the triangular ligament stretched between them, the tendons of the triceps, supraspinatus, and the fleshy portion of the deltoid, insurmountable obstacles to the luxation of the head of the bone, propelled by any force upward. Besides, what power could this be? Supposing there were such a force, the head of the bone must necessarily be driven outward as well as upward, ere its head would be displaced. This is impossible, because the trunk prevents the lower part of the arm from being directed sufficiently inward to produce this effect.

On the contrary, at the other margins, there is little resistance. At the inferior one, the long portion of the triceps; at the internal one, the tendon of the subscapularis; and at the external edge, those of the infra-spinatus, and teres minor, will readily yield to any power directed against them, and allow primitive luxations to take place, downward, inward, or outward. Downward, between the tendon of the long portion of the triceps, and the tendon of the subscapularis, which last, according to Mr. Cooper, is ruptured; (*Surg. Essays. Part 1, p. 7.*) inward, between the fossa subscapularis, and muscle of this name; outward, between the fossa infraspinata, and infraspinatus muscle.

After being pushed out of its cavity, and first placed in one of these three directions, the head of the humerus often changes its position; and then, to a *primitive* luxation, downward, or inward, a *consecutive* one succeeds. But, a consecutive could never follow a primitive dislocation outward, were this ever met with, as the spine of the scapula would form an obstacle.

A consecutive luxation inward may succeed a primitive one downward: indeed, nothing resists the head of the humerus, in the course which it then follows to get between the fossa subscapularis and the muscle similarly named. On the contrary, should it tend outward, it is opposed by the tendon of the triceps, and notwithstanding what Petit has written, Desault believed

that a consecutive dislocation in this direction never happens.

Sometimes, after the head of the bone has escaped from the internal or inferior part of the capsule, it is carried behind the clavicle, forming a case of consecutive dislocation upward; a specimen of which was preserved in Desault's museum. But, here, the secondary displacement only takes place slowly, and, when it occurs, a reduction can rarely be effected, on account of the strong adhesions, contracted by the surfaces of the bone. Thus, in the specimen referred to, a new cavity was formed behind the clavicle, and the humerus adhered by new kinds of ligaments to the surrounding parts.

The humerus then is subject to four kinds of dislocation. 1. Downward. 2. Outward. In these two directions the accident is always primitive. 3. Inward, which is sometimes primitive, sometimes consecutive. 4. Upward; a case which can never occur except as a consecutive one.

The second and fourth cases are so very rare in comparison with the others, that they alone claim attention.

CAUSES.

The action of external bodies, directed against the arm; but, particularly, falls, in which this part is forced against a resisting body, gives rise to primitive dislocations, and then the different species of the accident are determined, by the particular position of the humerus at the instant, when the injury takes place.

Should this bone be raised from the side, without being carried either forward or backward; should the elbow be elevated, and the fall take place on the side, then the weight of the trunk, almost entirely supported by this bone, forces downward its upper part which stretches and lacerates the lower part of the capsular ligament. Thus a luxation downward is produced, and its occurrence may also be facilitated by the combined action of the latissimus dorsi, pectoralis major, and teres major, muscles, as Fabre has judiciously remarked; for being at this period involuntarily contracted to support the trunk, they act with the power of a considerable lever; the resistance being the head of the bone, which they draw downward, while the fixed point is the lower end of the bone, resting against the ground. Some authors also consider, as the immediate cause of a dislocation downward, the strong action of the deltoid, which is supposed to depress the head of the bone, and push it downward through the capsular ligament. Certain observations seem incontrovertibly to establish this mode of dislocation. Bichat mentions the well-known case of a notary, who luxated his arm downward, in lifting up a register.

The rationale of the primitive luxation inward differs very little from that of the preceding case. The elbow is both separated from the side, and carried backward: in falling, the weight of the body acts on the

humerus, the front part of the capsule is lacerated, and a luxation takes place in this direction.

The dislocation outward is produced in the same sort of way. The elbow is carried forward, towards the opposite shoulder; the capsule is stretched outward, and if a sufficient force act on the limb, it is lacerated. But, how could such a force arise? In a fall, the arm being pushed against the trunk, and kept there, cannot move extensively enough to cause such a laceration. Hence, a luxation outward must necessarily be exceedingly rare, and Desault, in all his experience, never saw such an accident. Besides, when, in a fall, the arm is raised from the side, and inclined forward or backward, the weight of the body only operates upon it obliquely, and the limb is very little exposed to the action of the latissimus dorsi, pectoralis major, and teres major muscles. A few instances of a dislocation of the head of the humerus outward, however, have been recorded. In a dead subject, Boyer remarked a singular inclination of the glenoid cavity backwards, its articular surface, also, presenting on this side an extraordinary elongation, and the humerus readily slipping under the spine of the scapula. (*Traité des Mal. Chir. T. 4, p. 176.*)

In the patient whose history was published by M. Fizeau, and in whom a dislocation of the humerus outwards and backwards, was seen both by that gentleman and Boyer, there was also the particularity, that the luxation was readily reproduced. (*Journ. de Med. par. Corvisart, &c T. 10, p. 386.*)

Hence, Boyer suspects, that this very rare kind of displacement must have been facilitated by some preternatural disposition of the articular surfaces, especially that of the glenoid cavity. No dislocation must occur more frequently, than that downward, in which the influence of the weight of the body, and of the action of the muscles is direct. The luxation, inward, however, is common, and a multitude of cases, seen by Desault, confirm the reality of this kind of primitive dislocation, though doubted by several modern authors, who are disposed to think with Hippocrates, that all dislocations at first take place downward.

The capsule may only be stretched in a primitive luxation, and then the articular surfaces lose their relations but imperfectly; though most frequently, it is lacerated, and the head of the bone passes through the rupture. Indeed, in all primitive dislocations from violence, and not from paralysis of the deltoid, and a gradual yielding of the capsule, I believe the latter part is always extensively lacerated. In general, authors have paid too little attention to this circumstance, which dissections have repeatedly demonstrated to practitioners, and to Desault in particular. This eminent surgeon had two specimens made of wax; one, of a dislocation inward; the other of one downward; both of which were met with in subjects, who died at the Hôtel Dieu. Bell also makes mention of similar facts, and another

English surgeon, says Bichat, has observed the same occurrence. I suppose Bichat here alludes to Mr. Thompson, who long ago noticed the laceration of the capsule, and particularly called the attention of surgeons to the subject, in the *Medical Observations and Inquiries*.

Desault conceives that the capsule may be sufficiently torn to let the head of the bone escape; but that the opening may afterward form a kind of constriction round the neck of the humerus, so as to prevent the return of the head of the bone into the place, which it originally occupied. The correctness of this statement, however, is positively denied by Mr. A. Cooper, who remarks, that they who entertain this belief, must forget the inelastic structure of the capsular ligament, and never witnessed by dissection the extensive laceration which it suffers in dislocations from violence. (*Surgical Essays, Part. 1, p. 18.*)

When a consecutive luxation follows a primitive one, several causes may concur in producing it. If a fresh fall should happen, while the arm is separated from the trunk, the head of the humerus, which nothing confines, obeys, with the utmost facility, the power displacing it in this manner, and is again pushed out of the situation which it accidentally occupies.

A man in going down stairs, meets with a fall, and dislocates the humerus downward; he immediately sends for Desault, who defers the reduction till the evening. In the mean time, the patient in getting upon a chair, slips and falls again. The pain was more acute, than when the first accident occurred, and Desault, on his return, instead of finding the head of the humerus as it was in the morning, in the hollow of the axilla, finds it behind the pectoralis major muscle.

The action of muscles is a permanent cause of a new dislocation. When the humerus is luxated downward, the pectoralis major, and the deltoid draw upward, and inward, the upper part of this bone, which, only making a weak resistance to their action, changes its position, and takes one in the above double direction.

The various motions imparted to the arm, may also produce the same effect, according to their direction. Thus, in consequence of unskilful efforts to reduce the bone, a luxation inward frequently follows one downward.

SYMPTOMS.

In general, the diagnosis of dislocations of the humerus is attended with no difficulties.

Whatever may be the mode and situation of the dislocation, there always exists, as Hippocrates has remarked, a manifest depression under the acromion, which forms a more evident projection, than in the natural state. Almost all the motions of the arm are painful; some cannot be performed in any degree; and they are all very limited.

The arm cannot move without the shoulder moving also, because the articulation being no longer able to execute its functions, both it and the shoulder form, as it were, one body.

To these symptoms, generally characteristic of every sort of dislocation of the humerus, are to be added such as are peculiar to each particular case. When the luxation is downward, the arm is a little longer, than in the natural state; it is capable of being moved a little outward: but, an acute pain is the inevitable consequence of moving it either forward or backward. The elbow is more or less removed from the axis of the body by the action of the deltoid, and the long head of the biceps, and supraspinatus muscles, are stretched, contract and tend to draw the bone outward. The pain, which arises from this position, compels the patient to lean towards the dislocated limb, to keep the forearm half bent, and the elbow supported on his hip, in such a way, that the arm, having a resting place, may be sheltered from all painful motion, and stretching of the muscles. By this posture alone, Desault was in the habit of detecting a luxation downward, and his diagnosis was seldom found to be erroneous. Thus, in a fracture of the clavicle, the leaning posture of the patient is often, at the first glimpse, characteristic of the accident. In the axilla, a prominence, formed by the head of the humerus, may constantly be felt.

With the general symptoms of dislocations of the humerus, a luxation inward has the following: the elbow, separated from the axis of the body, is inclined a little backward; the humerus seems to be directed towards the middle of the clavicle; motion backward is not very painful, but that forward is infinitely so; there is a manifest prominence under the great pectoral muscle; the arm is very little longer than in the natural state; and the posture is the same, as in the foregoing case.

Were a dislocation outward to present itself, it would be particularly characterized by a hard tumour under the spine of the scapula; by the direction of the elbow forward; by its separation from the trunk; and by the somewhat increased length of the arm.

A projection behind the clavicle; a manifest shortening of the arm; and its direction; would clearly denote a dislocation upward.

Frequently, nothing is more difficult, than to determine, whether the case is a primitive dislocation inward, or a consecutive one; the same symptoms being observable in both cases. An accurate history of the case, by representing the order in which the symptoms occurred, can alone throw light on this point, which is the more interesting, as in the two cases, the means of reduction should vary. In the first, the head of the bone returns, through a short track, into its natural cavity; in the second, it has to tra-

verse a much greater distance to arrive there.

If, as Petit has pretended, there are dislocations backward, sometimes primitive, sometimes consecutive, this remark would be equally applicable to them.

Some analogous symptoms between dislocations of the humerus, the fracture of its neck, and luxations of the scapular end of the clavicle, might here create an uncertainty, if, in the latter case, the absence of a tumour in the armpit, and of a depression under the acromion, did not prevent an error. Uncertainty might arise, if in the fracture of the neck of the humerus, the proper symptoms of a fracture did not prevent a most detrimental mistake, which the occasional direction of the humerus, and a kind of prominence formed by the lower end of the fracture in the axilla, might otherwise cause. (See *Fracture of the Neck of the Humerus*.)

Inflammatory symptoms seldom follow dislocations of the humerus. Many authors, particularly B. Bell, speak of an oedematous swelling of the whole upper extremity, as a frequent consequence of a dislocation inward, and it is referred to the compression of the axillary glands. Experience has not often demonstrated this occurrence at the Hôtel Dieu, except in very old luxations; and when the thing has occurred, very beneficial effects have been obtained, in certain instances, by applying for a few days, a moderately tight bandage from the fingers up to the axilla, after the reduction has been accomplished. Bichat relates a case, in which the oedema did not disappear with the cause, but even rather increased; but the day after a bandage had been applied, the swelling was found diminished by one half.

There is another consequence, to which authors have paid but little attention; though it was known to Avicenna, and was several times observed by Desault. This is a palsy of the upper extremity, arising from the pressure, made by the head of the bone, when dislocated inward, upon the axillary plexus of nerves. This consequence sometimes resists every means of relief.

Indeed, when the nerves have been a long time compressed, the affection is very difficult of cure. Desault several times applied the moxa above the clavicle. The success, which he first experienced on some patients, did not follow invariably in others. But, when the head of the humerus has only made, as it were, a momentary pressure on the nerves, and the reduction has been effected, soon after the appearance of the symptoms, the paralytic affection often goes off of itself, and its dispersion may always be powerfully promoted by the use of volatile liniments.

OF THE REDUCTION.

We may refer to two general classes, the infinitely various number of means, proposed for the reduction of a dislocated humerus. The first are designed to push back,

by some kind of mechanical force, the head of the bone, into the cavity from which it is displaced, either with, or without making previous extension. The others are merely intended to disengage the head of the bone from the place which it accidentally occupies, leaving it to be put into its natural situation by the action of the muscles.

By the first means, art effects every thing; by the second, it limits its interference to the suitable direction of the powers of nature. In the first method, the force externally applied always operates on the bone in the diagonal of two powers, which resist each other at a more or less acute angle; in the last the power is only in one direction.

Here it is only necessary to state, that all the means, intended to operate in the first way, act nearly in the following manner. Something placed under the axilla, serves as a fulcrum, on which the arm is moved as a lever, the resistance being produced by the dislocated head of the humerus, while the power is applied either to the lower part of this bone, or the wrist. The condyles of the humerus being pushed downward and inward, the head of the bone is necessarily moved in the opposite direction, towards the glenoid cavity, into which it slips with more or less facility.

Thus operated the machine, so celebrated among the ancients and moderns, under the name of the ambi of Hippocrates; whether used exactly in the form described by him, or with the numerous corrections devised by Paul of Ægina, Ambrose, Paré, Duverney, Freke, &c. By this machine, a double motion is communicated to the head of the humerus, as above explained.

The extension usually moves the bone from its unnatural situation, and is executed in different ways. Sometimes, the weight of the body on one side, and the dragging of the end of the dislocated bone on the other, tend to produce this effect. Such was the action of the ladder, door, &c. described in Hippocrates's Treatise on Fractures, and repeated in modern works. Sometimes, the trunk is fixed in an unchangeable manner, while the arm is powerfully extended, as is practised in employing the machine of Oribasius, and was one of the methods formerly adopted in the public places, where wrestlers combated.

Sometimes, no extension is sensibly executed, and while the end of the humerus is pushed outward by a body placed under the axilla, the surgeon pushes it upward into the glenoid cavity.

We shall not here inquire into the inconveniences peculiar to each of these methods. Petit and B. Bell have already done so. We shall only point out the objections, common to all of them.

The exit of the head of the bone, through the lacerated capsule, is not necessarily attendant on the dislocation. Nor is it even possible to know with precision the situation of this opening. Why then should we

make use of an artificial force to direct the head of the bone towards this opening?

However covered the body placed under the axilla may be, to serve as a fulcrum, there is always a more or less inconvenient chafing, frequently dreadful stretching and laceration of parts, in consequence of its application, when the trunk is suspended upon it, as in the instance of the door, &c. In this way, Petit has seen a fracture of the neck of the humerus produced, and even a laceration and aneurism of the axillary artery.

Few surgeons have ready at hand the different kinds of apparatus. Hence, trouble and loss of time in getting them; time, which is of so much moment in the reduction; this being always the more easy, the sooner it is accomplished.

When the luxation is consecutive, how can mechanical means bring back the head of the bone, through the track it has taken? For instance, if to a dislocation downward one inward has succeeded, the head of the bone must necessarily be brought down, before it can be replaced in its cavity. The above artificial means often act repugnantly to the action of the muscles, which is a chief and essential agent in the reduction.

If the dislocation should be upward, they would obviously be ineffectual.

Perhaps, however, they might be advantageously employed, when a primitive luxation downward is quite recent, and when the head of the bone is very near its cavity. Then the inferior costa of the scapula presents an inclined plane, along which the end of the bone can easily glide, when propelled by any kind of external force. No doubt, it is to this tendency of the head of the bone to be replaced, that we must attribute the success, certainly exaggerated, but in part real, on which the inventor of such machines endeavours to establish the superiority of his plan.

But, in this case, it is useless to multiply artificial powers, when natural means suffice, and when we can accomplish the reduction with the hands more effectually, because we can vary the motions with more precision.

Thus Desault very often employed the following method with great success. The patient being seated upon a chair of moderate height, he took hold of the hand on the affected side, placed it between his knees, which he moved downward and backward, in order to make the extension and disengage the head of the bone, while an assistant held back the trunk to effect the counter-extension. This was sometimes executed by the weight of the body, and effort of the patient. At the same time, the surgeon's hands being applied to the arm, in such a way, that the four fingers of each were put in the hollow of the axilla, and the thumbs on the outer part of the arm, pushed upward, and a little outward, the head of the humerus, which usually returned with ease into its natural cavity.

Petit explains this plan, though not as

here described, but complicated with the use of a napkin, passed under the patient's axilla, and over the surgeon's neck, who contributes to raise the dislocated end of the bone, by lifting up his head. This accessory method was considered by Desault as useless and little methodical, preventing all variation in the direction of the impulse given to the head of the bone. The hands alone are always sufficient, and a multitude of instances attest the efficacy of this method, employed in Desault's way.

When the luxation downward was very recent, Desault in two, or three times, succeeded in reducing it, by a still more simple process. Marie-Louise Favert fell in going down stairs, dislocated her arm downward, and was conveyed, immediately after the accident, to the Hôtel-Dieu. Desault having recognized the disorder, placed his left hand under the axilla, to serve as a fulcrum, while with the right, applied to the lower and outer part of the arm, he depressed the humerus towards the trunk, and at the same time raised the upper part of the bone. The head of the humerus, directed upward and outward by this double motion, returned into the glenoid cavity, without the least resistance. The arm was placed in a sling for two days, and, on the fourth, the patient resumed her wonted labour.

Dislocations downward are not the only ones, to which the first of the above simple plans is applicable. Primitive luxation inward sometimes yield to its adoption. Two examples of such success are to be found in the *Journal de Chirurgie*.

REDUCTION BY EXTENSION ALONE.

For the most part, however, the preceding methods are inadequate, and extension must be made, which, when it is employed alone, forms a second sort of means for reducing dislocations of the shoulder. In ordinary cases of dislocation downward and forward, Celsus recommends simple extension. Albucasis was acquainted with no other mode. Douey, Douglas, and Heister, among the moderns, have absolutely rejected the use of machines, as always useless, and frequently dangerous. Lastly, Dapoui and Fabre examined with great exactness the process of extension, pointed out the manner of rendering it most advantageous in all cases, by the proper application of the extending force; and, in the dislocation of the humerus in particular, they obviated the inconvenience of pulleys, placed under the arm-pit on the affected side, and proved that the motion, vulgarly termed coaptation, was of no utility.

In order to reduce a dislocation of the humerus, it is necessary to have a sufficient number of assistants, so as to increase the power according to the resistance which is to be overcome. But, two are usually sufficient for making the extension: in doing which, one should employ a linen pad, of sufficient thickness to project above the level of the pectoralis major, and latissimus dorsi. There must also be two bandages.

one made of linen, several times doubled, four inches wide, and eight or nine feet long; the other a towel, folded in the same way, but not always wanted.

The patient may either sit in a chair of moderate height, or lie down upon a table, which is firmly fixed, and covered with a mattress.

Desault, for a long while, used to put the patient in the first of these positions, which, indeed, is generally preferred. In it the arm may be advantageously drawn in a transverse direction; but if, as is often the case, there be occasion to make extension upward or downward, the assistant is then obliged to rise up, and depress himself, has not sufficient power, finds himself obstructed, and cannot vary, at the pleasure of the surgeon, the direction in which the arm is to be extended. This position is also much more fatiguing to the patient, than one in which the trunk is equally supported upon a horizontal plane. Hence, Desault, in the latter years of his practice, abandoned the first position, and invariably adopted the last.

The patient being put in the proper position, the linen compress is applied to the axilla, on the side affected, and upon this compress the middle of the first extending bandage is placed, the two heads of which ascend obliquely before and behind the chest, meet each other at the top of the sound shoulder, and are held there by an assistant, so as to fix the trunk, and make the counter extension. The action of this bandage does not affect the margin of the pectoralis major and latissimus dorsi, in consequence of the pad projecting higher than them. If this were not attended to, these muscles being drawn upward, would pull the humerus in this direction, and thus destroy the effect of the extension, which is to be made in the following manner:—

Two assistants take hold of the fore-arm, above the wrist; or else the towel, doubled several times, is to be applied to this part. The two ends are to be twisted together, and held by one or two assistants, who are to begin pulling in the same direction in which the humerus is thrown. After this first proceeding, which is designed to disengage the head of the bone from its accidental situation, another motion is to be employed, which differs according to the kind of luxation. If this should be downward, the arm is to be gradually brought near the trunk, at the same time that it is gently pushed upward. Thus, the head of the bone being separated from the trunk, and brought near the glenoid cavity, usually glides into this situation with very little resistance.

When the luxation is inward, after the extension has been made in the direction of the humerus, the end of this bone should be inclined upward and forward, in order that its head may be guided backward; and *vice versa*, when the luxation is outward.

When the head of the bone has been disengaged by the first extension, the motion imparted to it by the rest of the extension,

should in general be exactly contrary to the course which the head of the bone has taken, after quitting the glenoid cavity.—When there is difficulty experienced in replacing the head of the bone, we should, after making the extension, move the bone about in various manners, according to the different direction of the dislocation, and the principle just noticed. This plan often accomplishes what extension alone cannot; and the head of the bone, brought by such movements towards its cavity, returns into it, during their execution.

When the dislocation is consecutive, it is the first extension, made in the direction of the displaced bone, which brings back its head to the situation where it was primitively lodged, and the case is then to be managed just as if it were a primitive dislocation. Often it is only at the moment of the reduction, that it is possible to distinguish, whether a luxation is of one or the other kind. Indeed, as the reduction mostly takes place of itself, when the extension is properly made, if the head be situated consecutively inward, it is seen to descend along the internal part of the scapula, then to proceed to the lower part, and, lastly, to ascend towards the opening in the capsule, into which it returns.

When the extension is properly made, the reduction is almost spontaneously effected. Indeed, whatever may be the kind of primitive dislocation, it is clear, that the muscles on one side of the articulation must be put upon the stretch, while those on the other must be relaxed. Hence, a change must necessarily follow both in their directions and contractions, and also in the direction of these contractions. From this change, the muscles, when they act, instead of drawing back the head of the bone towards the ruptured capsule, pull it in another direction, and thus produce a consecutive dislocation.

But, if by rectifying things, the extension should chance to restore to the muscles their former direction, then obeying their natural irritability, increased by the stretching of the extending power, they will bring back the head of the bone to the opening in the capsule, and oblige it to enter with much more certainty, than the efforts of a surgeon could do, who is always ignorant of the precise situation of this opening.

It follows from what has been said:—1. That all the art of treating dislocations, consists in giving a proper direction to the extending force. 2. That in general the coaptation is useless. 3. That reducing a dislocation does not consist in putting back the head of the bone into its cavity; but, in putting the muscles in a proper state for accomplishing this reduction, and that here, as every where else, art is only the hand-maid of nature.

There are cases, however, in which the action of the muscles, being perverted by the oldness of the dislocation, and by the adhesions contracted with the surrounding parts, it becomes necessary to employ such means, as will serve to force, as it were, the

head of the bone into its cavity, to which the muscles cannot bring it.

With reasoning is combined experience, which is always the most effectual proof of this doctrine, both respecting reductions of the dislocated humerus, and of such accidents in general. Desault only employed extension, variously diversified, till he had put the muscles in a state favourable for accomplishing reduction. The most prompt success constantly crowned this part of his practice, and, doubtless, much of this success must be imputed to his wisely refusing to interfere in too great a degree.

For the purpose of preventing the head of the bone from slipping out of its place again, the elbow should be kept some days quiet, and close to the side in a sling. After the reduction of a dislocation, which has happened downward, the facility of a fresh displacement is said to depend very much upon the extent to which the tendon of the subscapularis muscle has been lacerated. (*A. Cooper's Surgical Essays, Part 1, p. 7.*)

The French apply the bandage, which Desault recommended for the fractured clavicle.

OF SOME CIRCUMSTANCES, RENDERING THE REDUCTION DIFFICULT.

1. Narrowness of the opening in the Capsule.

While Desault considers this circumstance as one of the chief impediments to the return of the head of the humerus into the glenoid cavity, Pott and Mr. A. Cooper are of opinion, that the capsular ligament can never create any such difficulty. According to Desault, the obvious indication is to enlarge such an opening, by lacerating its edges. This is fulfilled by moving the bone about freely, in every direction, particularly in that in which the dislocation has taken place. Now, by pushing the head of the bone against the capsule already torn, the latter becomes lacerated still more, in consequence of being pressed between two hard bodies. The reduction, which is frequently impracticable before this proceeding, often spontaneously follows, immediately after it has been adopted. In the *Journal de Chirurgie* are two cases, by Anthaume and Faucheron, establishing this doctrine.

Mr. C. White, of Manchester, also believed, that the reduction was sometimes prevented by the head of the bone not being able to get through the laceration in the capsule again. He succeeded in reducing some cases which he supposed to be of this nature, in the following manner: having screwed an iron ring into a beam at the top of the patient's room, he fixed one end of the pulleys to it, and fastened the other to the dislocated arm by ligatures attached to the wrist, placing the arm in an erect position. In this way he drew up the patient, till his whole body was suspended; but, that too much force might not be sustained by the wrist, Mr. White at the same time

directed two other persons to support the arm above the elbow. He now used to try with his hands to conduct the arm into its place, if the reduction had not already happened, as was sometimes the case. Occasionally, a snap might be heard, as soon as the patient was drawn up; but, the reduction could not be completed, till he was let down again, and a trial made with the heel in the arm pit. When no iron ring was at hand, Mr. White used to have the patient raised from the ground by three or four men, who stood upon a table. (*Cases in Surgery, p. 95.*)

2. Oldness of the Dislocation.

This is a second impediment to reduction, still more difficult to surmount than the foregoing. The head of the bone, which has lodged a long while in its accidental situation, contracts adhesions to it. The surrounding cellular substance becomes condensed, and forms, as it were, a new capsule, which resists reduction, and which, when such reduction cannot be accomplished, supplies in a certain degree, the office of the original joint, by allowing a considerable degree of motion.

In such cases, the common advice is, that no attempt at reduction should be made, as it would be useless in regard to the dislocation, and might be injurious to the patient, from the excessive stretching of parts. This was for some time the doctrine of Desault; but, in his latter years, experience led him to be bolder.

Complete success, obtained in dislocations, which had existed from fifteen to twenty days, encouraged him to attempt reduction at the end of thirty, and thirty-five days, and, in the two years preceding his death, he succeeded, three or four times, in reducing dislocations which had existed two months and a half, and even three months, both when the head of the bone was situated at the lower, and at the internal part of the scapula.

However violent or protracted the extension may have been, none of the terrible consequences with which authors threaten us, ever occurred. One accident, which it was difficult to foresee, and of which we shall speak presently, only took place in two instances.

In these cases, it is necessary, before making the extension, to move the bone about extensively in all directions, for the purpose of first breaking its adhesions, lacerating the condensed cellular substance, which forms an accidental capsule, and of producing, as it were, a second dislocation, in order to remove the first. Extension is then to be made in the ordinary way, but with an additional number of assistants.

The first attempts frequently fail, and the dislocated head of the bone continues unmoved, notwithstanding the most violent efforts. In this case, after leaving off the extension, the arm is to be again moved about most extensively. The humerus is to be carried upward, downward, forward,

and backward. Force the resistances. Let the arm describe a large segment of a circle, in the place where it is situated. Let it be once more rotated on its axis; then let the extension be repeated, and directed in every way. Thus, the head of the bone will first be disengaged by the free motion, and afterward reduced.

In these cases, when the dislocation, in consequence of being very old, presents great obstacles to reduction, even though the attempts made for this purpose should fail, they are not entirely useless. By forcing the head of the bone to approach the glenoid cavity, and even placing it before the cavity, and making it form new adhesions, after the destruction of the old ones, the motions of the arm are rendered freer. Indeed, they are always the less obstructed, the nearer the head of the bone is to its natural situation. Notwithstanding the encouragement, given by Desault, to making attempts to reduce old dislocations of the humerus, experience proves, that when the bone has been out of its place more than a month, success is rarely obtained. And as for the danger which may arise from long protracted immoderate force, a case, which, I have elsewhere cited, proves, that caution is here a virtue, which cannot be too highly commended. (See *First Lines of Surgery*, Vol. 2, p. 465.)

3. Contractions of the Muscles.

A third impediment to the reduction of every kind of dislocation, is the power of the muscles, which is augmented beyond the natural degree, in consequence of their being on the stretch. Sometimes, this power is so considerable, that it renders the head of the bone immoveable, though the most violent efforts are made. Here the means to be adopted are such as weaken the patient, bleeding, the warm bath, nauseating doses of tartarized antimony, as advised by Loder, Mr. A. Cooper, &c.; opium, &c. Should the patient happen to be intoxicated at the time of his being first seen by the surgeon, the opportunity would be very favourable to reduction, as the muscles would then be capable of less resistance. Extension unremittingly, but not violently, continued for a length of time, will ultimately fatigue the resisting muscles, and overcome them with more safety and efficacy, than could be accomplished by any sudden exertion of force. In all cases of difficulty, pulleys should be preferred.

The swelling about the joint, brought on by the accident, usually disappears without trouble.

Another consequence, which seldom occurs in practice, but which Desault saw twice, is a considerable emphysema, suddenly originating at the time of reduction. In the middle of such violent extension, as the long standing of the dislocation requires, a tumour suddenly makes its appearance under the great pectoral muscle. Rapidly increasing, it spreads towards the armpit, the whole extent of which it soon occupies. It

reaches backward, and, in a few minutes, sometimes becomes as large as a child's head. A practitioner, unacquainted with this accident, might take it for an aneurism, occasioned by the sudden rupture of the axillary artery, by the violent extension. But, if attention be paid to the elasticity of the tumour, its fluctuation, the situation where it first appears, commonly under the great pectoral muscle, and not in the axilla; the continuance of the pulse; and the unchanged colour of the skin; the case may easily be discriminated from a rupture of the artery. (*Œuvres Chir. de Desault, par Bichat, T. 1.*)

For dispersing the above kind of swelling, the lotio plumbi acetatis, and gentle compression with a bandage, are recommended.

I shall conclude the subject of luxations of the shoulder with the following singular observation, recorded by Baron Larrey.

"Among the curious anatomical preparations, (says he) which I saw in the cabinet of the University of Vienna, there was a dissected thorax, shown to me by Professor Prokaska, in which the whole orbicular mass of the head of the right humerus, engaged between the second and third true ribs, projected into the cavity of the chest. This singular displacement was the result of an accidental luxation occasioned by a fall on the elbow, while the arm was extended and lifted from the side. The head of the humerus, after tearing the capsular ligament, had been violently driven into the hollow of the axilla, under the pectoral muscles, so as to separate the two corresponding ribs, and pass between them. The diameter of the head of the bone surmounted this obstacle, and penetrated entirely into the cavity of the thorax, pushing before it the adjacent portion of the pleura. Every possible effort was made in vain to reduce this extraordinary dislocation. The urgent symptoms, which arose, were dissipated by bleeding, warm bathing, and antiphlogistic remedies. The arm, however, remained at a distance from the side, to which condition, the patient became gradually habituated, and, after several years of suffering and oppression, he at length experienced no inconvenience. The patient was about sixteen or seventeen, when he met with the accident; and he lived to the age of thirty-one, when he died of some disease, which had no concern with the dislocation. His physicians were anxious to ascertain the nature of this curious case, of which they had been able to form only an imperfect judgment. They were much surprised to find, upon opening the body, the head of the humerus lodged in the chest, surrounded by the pleura, and its neck closely embraced by the two ribs above specified. They were still more astonished to find, instead of a hard spherical body covered with cartilage, only a very soft membranous ball, which yielded to the slightest pressure of the finger. The cartilage and osseous texture of the whole portion of the humerus, contained within the cavity of the chest, had entirely disappeared. *Les absorbans s'en étaient emparés* (says M. Larrey.)

et comme autant de gens si fidèles, ils avaient cherché à détruire par portions, n'ayant pu l'expulser en masse, un ennemi qui s'était furtivement introduit dans un domicile où sa présence devait être importune et nuisible. Of the humerus, there only remained some membranous rudiments of its head, and a great part of these seemed to belong to the pleura costalis. (See *Larrey's Mémoires de Chirurgie Militaire*, Tom. 2, p. 405—407.

DISLOCATIONS OF THE FORE-ARM FROM THE HUMERUS.

Notwithstanding the extent of the articular surfaces of the radius and ulna, the strength of the muscles and ligaments surrounding the joint, and the mutual reception of the bony eminences, rendering the articulation a perfect angular ginglymus, a dislocation of both the radius and ulna off the humerus, is an accident for which a surgeon is sometimes consulted. The radius and ulna are most frequently luxated backward; sometimes laterally, but very rarely forward: the latter luxation cannot occur without a fracture of the olecranon. Indeed, it is so uncommon, that neither Petit nor Desault ever met with it. The luxation backwards is facilitated by the small size of the coronoid process, which may slide behind the humerus, when this is forcibly pushed downwards and forwards, and ascend as high as the cavity, which receives the olecranon in the extended state of the fore-arm.

Lateral luxations are much less frequent, and are always incomplete. The great extent of the articular surfaces in the transverse direction, the reciprocal adaptation of their inequalities, and especially the strength of the ligaments and muscles, which, arising from the internal and external condyles of the inferior extremity of the humerus, go to the fore-arm and hand, give great strength to the articulation, and render it nearly impossible for any violence to produce a complete lateral luxation, which also, if it were to occur, would be attended with such mischief to the soft parts, as would require immediate amputation.

In the luxation backwards, the radius and ulna may ascend more or less behind the humerus; but the coronoid process of the ulna is always carried above the articular pulley, and is found lodged in the cavity destined to receive the olecranon. The head of the radius is placed behind and above the external condyle of the humerus. The annular ligament, which confines the superior extremity of the radius to the ulna, may be lacerated: in which case, even when the bones are reduced, it is difficult to keep them in their proper places, as the radius tends constantly to quit the ulna.

This accident always takes place from a fall on the hand; for, when we are falling, we are led by a mechanical instinct to bring our hands forwards to protect the body. If in this case the superior extremity, instead of resting vertically on the ground, be placed

obliquely with the hand nearly in a state of supination, the repulsion which it receives from the ground will cause the two bones of the fore-arm to ascend behind the humerus, whilst the weight of the body pressing on the humerus, directed obliquely downwards, forces its extremity to pass down before the coronoid process of the ulna.

The fore-arm is in a state of half flexion, and every attempt to extend it produces acute pain. The situation of the olecranon, with respect to the condyles of the humerus, is changed. The olecranon, which, in the natural state, is placed on a level with the external condyle, which is itself situated lower than the internal, is even higher than the latter.

The case may be mistaken for a fracture of the olecranon, of the head of the radius, or even of the inferior extremity of the humerus. Such a mistake is attended with very bad consequences; for, if the reduction be not effected before the end of fifteen or twenty days, the reduction afterward is frequently impossible. The swelling which supervenes in twenty-four hours after the accident, renders the diagnosis more difficult; but, notwithstanding the assertion of Boyer, I believe the olecranon and internal condyle, are never so obscured, that the distance between them cannot be felt to be increased. It is true, that the rubbing of the coronoid process and olecranon against the humerus, may cause a grating noise, similar to that of a fracture; and some attention is certainly requisite to establish a diagnosis between a fracture of the head of the radius, and a dislocation of the fore-arm backwards.

As Boyer observes, when we consider the extent of the articular surfaces, and the great distance which they must be thrown ere they cease to be in contact, it is evident that a luxation backward must be attended with serious injury of the surrounding soft parts. The lateral ligaments are also constantly ruptured, and sometimes the annular ligament of the radius. Probably the lower insertions of the biceps and brachialis internus would likewise be more frequently lacerated, by the violent protrusion of the head of humerus forwards, were it not, that their attachments are at some distance from the joint. This mischief, however, occasionally takes place, and then the fore-arm is observed to be readily placed in any position, and not to retain one attitude, as is generally the case in dislocations. The lower end of the humerus, indeed, has been known not only to lacerate these muscles, but to burst the integuments, and present itself externally; an instance of which is recorded by Petit, and two such cases I saw myself during my apprenticeship at St. Bartholomew's. Boyer justly remarks, that it is difficult to conceive how, under these circumstances, the brachial artery and median nerve can escape. In fact, this vessel has sometimes been ruptured, and mortification of the limb been the consequence; but, this injury of the artery, and the laceration of the muscles and skin are rare occurrences. (*Traité des Mal. Chir.*

T. 4, p. 215.) Nor, if the artery were wounded, would gangrene be invariably the result; for, if my memory is correct, an instance in which the limb was saved, notwithstanding such a complication, is mentioned by Mr. Abernethy in his lectures, though, no doubt the risk would be great.

The following method of reducing the case, is advised by Boyer:—The patient being firmly seated, an assistant to take hold of the middle part of the humerus, and make counter-extension, while another assistant makes extension at the inferior part of the fore-arm. The surgeon, seated on the outside, grasps the elbow with his two hands, by applying the fore-fingers of each to the anterior part of the humerus, and the thumbs to the posterior, with which he presses on the olecranon, in a direction downwards and forwards. This method will in general be successful. If the strength of the patient, or the long continuance of the luxation, render it necessary to employ a greater force, extension is to be made with a towel applied on the wrist, and a cushion is to be placed in the axilla, and the arm and trunk fixed, as is done in cases of luxation of the humerus.

A bandage may afterwards be applied, in the form of a figure 8, and the arm kept in a sling. The laceration, which always takes place, is invariably followed by more or less swelling, which is to be combated by antiphlogistic means.

At the end of seven or eight days, when the inflammatory symptoms are nearly gone, the articulation is to be gently moved, and the motion is to be increased every day, in order to prevent an anchylosis, to which there is a great tendency.

In this luxation, the annular ligament which confines the head of the radius to the extremity of the ulna, is sometimes torn, and the radius passes before the ulna. In such cases pronation and supination are difficult and painful, though the principal luxation has been reduced. The head of the radius may be easily replaced by pressing it from before backwards, and it is to be kept in its place by a compress, applied to the superior and external part of the fore-arm. The bandage and compress are to be taken off every two or three days, and reapplied. This is advisable, on account of the necessity of moving the articulation to prevent anchylosis.

If the luxation be not soon reduced, it becomes irreducible; the heads of the radius and ulna grow to the backpart of the humerus, and the patient can neither bend nor extend his arm. However, in certain cases, especially in young persons, some motion is in time acquired; the heads of the radius and ulna forming for themselves cavities in the humerus, in which they perform some motions, but always imperfectly.

In a modern publication, an instance of a dislocation of the heads of the radius and ulna backward is related, where the lower end of the humerus protruded through the integuments, and as it could not be reduced,

it was sawn off. The patient, a boy, recovered the full use of his arm. (*Evans, Pract. Obs. on Cataract; Compound Dislocations, &c. p. 101, Wellington, 1815.*)

A luxation forwards should be treated as a fracture of the olecranon, with which it would be inevitably accompanied. Here, on account of the great injury done to the soft parts, it would also be right to bleed the patient copiously, and put him on the antiphlogistic regimen.

As to lateral luxations, either inwards or outwards, they are always incomplete, and easily discovered. They are reduced by extending the humerus and fore-arm, and at the same time pushing the extremity of the humerus, and the two bones of the fore-arm in opposite directions.

These luxations cannot be produced without considerable violence; but when the bones are reduced, they are easily kept in their place. It will be sufficient to pass a roller round the part, to put the fore-arm in a middle state, neither much bent nor extended, and to support it in a sling. But much inflammation is to be expected from the injury done to the soft parts. In order to prevent, or at least mitigate it, the patient is to be bled two or three times, and put on a low diet, and the articulation is to be covered with the lotio plumbi acet. or an emollient poultice. It is scarcely necessary to repeat, that the arm is to be moved as soon as the state of the soft parts will admit of it. (*Boyer, sur les Maladies des Os, T. 2.*)

A dislocation of the fore-arm backward, is said to occur ten times as frequently as lateral luxations; and those forward are so rare, that no comparison whatever can be drawn. (*Euvres Chir. de Desault, T. 1.*)

An incomplete lateral luxation may be produced by a blow, which drives the upper part of the fore-arm violently outward, or inward. A footman, says Petit, in falling from a coach, had his arm entangled in the spokes of a wheel, and a dislocation outward was the consequence. Another man luxated his fore-arm inward, by falling from his horse and driving his arm against an uneven place.

When the ulna is pushed into the situation of the radius, the space between the olecranon and internal condyle is much greater than natural, and the radius cannot be easily rotated, nor the fore-arm bent and extended, in a perfect manner.

The dislocation inward must be uncommon, as the form of the bones is almost an insurmountable obstacle to such an accident. It may happen, however, as the authority of Petit confirms.

All recent dislocations of the elbow are easily reduced, and as easily maintained so; for a displacement is prevented by the reciprocal manner in which the articular surfaces receive each other, and by their mutual eminences and cavities. This consideration, however, should not lead us to omit the application of a bandage in the form of a figure 8, and supporting the arm in a sling.

DISLOCATION OF THE RADIUS FROM THE ULNA.

The majority of authors, who have written on dislocations of the fore-arm, have not separately considered those of the radius. Some detached observations, on luxations of its superior extremity, are to be found here and there; a subject, which was first well treated of by Duverney. But, dislocations of its lower end, which are more frequent, remained unnoticed, until Desault favoured the profession with a particular account of them.

The radius, the moveable agent of pronation and supination, rolls round the ulna, which forms its immoveable support, by means of two articular surfaces; one above, slightly convex, broad internally, narrow outwardly, and corresponding to the little sigmoid cavity of the ulna, in which it is lodged; the other below, concave, semi-circular, and adapted to receive the convex edge of the ulna. Hence, there are two joints, differing in their motions, articular surfaces, and ligaments.

Above, the radius, in pronation and supination, only moves on its own axis; below, it rolls round the axis of the ulna. Here, being more distant from the centre, its motions must be both more extensive and powerful, than they are above. The head of the radius, turning on its own axis in the annular ligament, cannot distend it in any direction. On the contrary, below the radius, in performing pronation, stretches the posterior part of the capsule, and presses it against the immoveable head of the ulna, which is apt to be pushed through, if the motion be forced. A similar event, in a contrary direction, takes place in supination. The front part of the capsule, being rendered tense, may now be lacerated.

Add to this disposition, the difference of strength between the ligaments of the two joints. Delicate and yielding below; thick and firm above; their difference is very great. The upper head of the radius, supported on the smaller immoveable articular surface of the ulna, is protected from dislocation in most of its motions. On the contrary, its lower end, carrying along with it, in its motions, the bones of the carpus, which it supports, cannot itself derive any solid stability from them.

From what has been said, the following conclusions may be drawn: 1. That with more causes of luxation, the lower articulation of the radius has less means of resistance; and that under the triple consideration of motions, ligaments tying the articular surfaces together, and the relations of these surfaces to each other, this joint must be very subject to dislocation. 2. That, for opposite reasons, the upper joint must rarely, or according to Desault, never be exposed to such an accident. This author here excludes from consideration, cases in which the annular ligament of the radius is lacerated in a luxation of both heads of the radi-

us and ulna backwards; an accident, the reality of which is admitted. But, Desault particularly confines his doubts to a dislocation of the upper head of the radius from the lesser sigmoid cavity of the ulna, as a single and uncomplicated injury, suddenly produced by an external cause, and, therefore, neither to be confounded with the cases above specified, nor with other examples, in which the displacement happens slowly, especially in children, in consequence of a diseased or relaxed state of the ligaments.

Notwithstanding the opinion of Desault, some instances of dislocation of the upper head of the radius, suddenly produced by external causes, are recorded by Duverney; the particulars of another case were transmitted to the French Academy of Surgery; and I have lately been informed of four examples, which have been met with in this country.

Two of these cases occurred in the practice of Mr. Dunn, of Scarborough; one in that of Mr. Lawrence; and the other was attended by Mr. Earle. Baron Boyer says, that many instances are now known, in which the upper head of the radius has been dislocated backwards; indeed, in opposition to what Desault has stated, he asserts, that dislocations of the lower joint between the radius and ulna are more rare, than those of the upper joint between the same bones. The latter accident he has twice seen himself, but he believes that no authentic case of a dislocation forwards is yet upon record. (*Mal. Chir. T. 4, p. 248.*)

The displacement backwards is described by this author, as occurring more readily and frequently in children, than in adults, or old subjects. The reason of this circumstance is ascribed to the lesser firmness both of the ligaments, and of the tendinous fibres of the exterior muscles, which fibres, in a more advanced age, contribute greatly to strengthen the external lateral ligament. In a child, also, the little sigmoid cavity of the ulna is smaller, and the annular ligament, extending further round the head of the radius, is longer, and more apt to give way. Hence, in a subject of this description, efforts, which may not at first produce a dislocation, if frequently repeated, cause a gradual elongation of the ligaments, a change in the natural position of the bones, and, at length, a degree of displacement as great as in a case of luxation, suddenly and immediately effected. (*Traité des Mal. Chir. T. 4, p. 239.*)

Another fact, mentioned by Boyer, is, that the dislocation of the upper head of the radius backwards is always complete, its articular surfaces being perfectly separated both from the lower end of the humerus, and from the little sigmoid cavity of the ulna. The usual cause of the accident is a pronation of the fore-arm, carried with great violence beyond the natural limits.

In a dislocation of the head of the radius backwards, the fore-arm is bent, and the hand fixed in the state of pronation. Supi-

nation can neither be performed by the action of the muscles, nor by external force; and every attempt to execute this movement produces a considerable increase of pain. The hand and fingers are moderately bent, and the upper head of the radius may be observed forming a considerable projection behind the lesser head of the humerus. In the case, which was mentioned to me by my friend Mr. Lawrence, the head of the radius lay upon the outside of the external condyle.

The reduction is to be accomplished by extending the fore-arm, and endeavouring to bring it into the supine posture, at the same time, that the surgeon tries to press with his thumb the head of the radius forwards, towards the lesser tubercle of the humerus, and into the little sigmoid cavity of the ulna again. Success is indicated by the patient being now able to perform the supine motion of the hand, and to bend and extend the elbow with freedom.

For the purpose of preventing a return of the displacement, and giving nature an opportunity of repairing the torn ligaments, measures must be taken to hinder the pronation of the hand. Boyer recommends with this view a roller, compresses, and a sling; but, it appears to me, that a splint, extending nearly to the extremity of the fingers, and laid along the inside of the fore-arm, with a pad of sufficient thickness to keep the hand duly supine, would be right, in addition to the sling, roller, &c.

DISLOCATION OF THE LOWER END OF THE RADIUS.

The causes are, 1. Violent action of the pronator and supinator muscles. Thus, Desault has published the case of a laundress, who dislocated the lower end of the ulna backwards from the radius, by a powerful pronation of her hand in twisting a wet sheet. (*Boyer, Traité des Mal. Chir. T. 4, p. 249.*)

2. External force, moving the radius violently into a state of pronation, and rupturing the back part of the capsule; or into a state of supination, and breaking its fore-part.

Hence, there are two kinds of dislocation; one of the radius forward; the other, backward. The first is very frequent; the second is much less so. The latter case never presented itself to Desault, but once, in the dead body of a man, who had both his arms dislocated, and of whose accident no particulars could be learnt. The head of the ulna was found placed in front of the sigmoid cavity of the radius, and in contact with the os pisiforme, to which it was connected by a capsular ligament. (*Boyer, Traité des Mal. Chir. T. 4, p. 249.*)

The other case in which the ulna was thrown backwards, occurred very often. Doubtless, this difference is owing to all the principal motions of the radius being in the prone direction.

This observation is confirmed by the fact,

that the lower joint of the radius, in the dead subject, may be dislocated as easily by a supine, as a prone motion of this bone.

The symptoms of a luxation of the lower end of the radius from the ulna forward are; constant pronation of the fore-arm; an inability to perform supination, and great pain on this being attempted; an unusual projection at the back of the joint, in consequence of the protrusion of the little head of the ulna through the capsule; the position of the radius is more forward, than natural; constant adduction of the thumb, which is almost always extended; a half-bent state of the fore-arm, and very often of the fingers, which posture cannot be changed, without considerable pain. More or less swelling around the joint. This sometimes comes on immediately, but always afterward, if the reduction remain unaccomplished. The condition of the joint may thus be obscured, and the accident mistaken for a sprain. The serious consequence of this mistake is, that no attempt at reduction is made, and the articular surfaces having time to contract adhesions, the disorder is rendered irremediable, and the prone and supine movements of the hand, are for ever lost, and the action of the fingers seriously impaired.

A luxation of the radius backward is characterized by symptoms the reverse of those above mentioned. They are a violent supination of the limb; inability to put it prone; pain on making the attempt; a tumour in front of the fore-arm formed by the head of the ulna; a projection backward of the large head of the radius; and abduction of the thumb.

When the dislocation is forward, an assistant is to take hold of the elbow, and raise the arm a little from the body; while another is to support the hand and fingers.

The surgeon is to take hold of the end of the fore-arm with both his hands; one applied to the inside, the other to the outside, in such a manner, that the two thumbs meet each other in front of the limb, between the ulna and radius, while the fingers are applied to the back of the wrist. He is then to endeavour to separate the two bones from each other, pushing the radius backward, and outward, while the ulna is held in its proper place. At the same time, the assistant, holding the hand, should try to bring it into a state of supination, and consequently the radius, which is its support. Thus pushed, in the direction opposite that of the dislocation, by two powers, the radius is moved outward, and the ulna returns into the opening of the capsule, and into the sigmoid cavity.

If chance should present a dislocation of the lower head of the radius backward, or in other words, of the lower head of the ulna forwards, the same kind of proceeding, executed in the opposite direction, would serve to accomplish the reduction. (*See Œuvres Chir. de Desault, T. 1.*) The history of such a case is recorded by Boyer. (*Mal. Chir. T. 4, p. 253.*)

DISLOCATIONS OF THE WRIST.

The carpal bones may be luxated from the lower ends of the radius and ulna forwards, backwards, inwards, or outwards. The first two cases, especially that backwards, are the most frequent. The dislocation backwards is rendered easy by the direction of the convex articular surfaces of the scaphoid, lunar, and cuneiform bones, which sloping more backwards than forwards, must make them more disposed to slip in this direction, than any other. The accident may be caused by a fall on the back of the hand, while much bent; in which event the first row of the carpal bones slide backwards into the oblong cavity of the radius, lacerate the posterior ligament, and form an eminence behind the lower ends of the bones of the fore-arm. This prominence, the depression in front of the wrist, and the extraordinary flexion of the hand, which cannot be extended, are the characteristic signs of this kind of dislocation. The dislocation forwards generally arises from a fall on the palm, the fingers being extended, and more force operating on the lower than upper part of the palm. The luxation is sometimes not complete; and the hand remains painfully extended. As many tendons run before the wrist, and the annular ligament is pushed forward, the prominence formed by the carpal bones, in front of the ends of the radius and ulna, is not easily detected, and the case may be mistaken for a sprain.

Dislocations inwards, or outwards, are never complete. The projection of the carpal bones at the inner or outer side of the joint, and the distortion of the hand, make such cases sufficiently evident.

Recent dislocations of the wrist, particularly such as are incomplete, are easy of reduction; but when the displacement has been suffered to continue some time, more difficulty is experienced, and in a few days, all attempts are generally unavailing. This observation applies to all dislocations of ginglymoid joints; and I cannot, therefore, too strongly condemn the waste of time in trials to disperse the swelling of the soft parts, ere the bones are replaced; an absurd plan, which I am sorry to say, is sanctioned by Boyer. (*Mal. Chir. T. 4, p. 260.*)

For the purpose of reducing the dislocated bones, gentle extension must be made, while the two surfaces of the joint are made to slide on each other in a direction contrary to what they took when the accident occurred.

In dislocations of the wrist, numerous tendons are always seriously sprained, and many ligaments lacerated; consequently a good deal of swelling generally follows, and the patient is a long time in regaining the perfect use of the joint. Hence, the propriety of bleeding, low diet, and opening, cooling medicines; while the hand and wrist should be continually covered with linen wet with the *lotio plumbi acetatis*, and the fore-arm

and hand kept in splints, which ought to extend to the end of the fingers, so as to prevent a return of the displacement. The limb must also remain quiet in a sling.

When the ruptured ligaments have united, liniments will tend to dispel the remaining stiffness and weakness of the joint.

Sometimes the lower head of the radius is driven through the skin at the inside of the wrist, between the radial artery, and the mass formed of the flexor tendons of the wrist and fingers. Cases of this description, when well managed, generally have a favourable termination, as we see in the case reported by M. Thomassin. (*Journ. de Med. T. 39.*)

If the smallness of the opening in the skin cause an impediment to reduction, the integuments should be divided with a knife.

DISLOCATIONS OF THE CARPUS, METACARPUS, FINGERS AND THUMB.

A dislocation of the carpal bones from each other seems almost impossible. The *os magnum*, however, has been known to be partially luxated from the deep cavity formed for it in the *os scaphoides* and *os lunare*. This displacement is produced by too great a flexion of the bones of the first phalanx on those of the second, and the *os magnum* forms a tumour on the back of the hand. (*Chopart; Boyer; Richerand.*)

Chopart once met with a partial luxation of the *os magnum* in a butcher. Baron Boyer has seen several examples of the accident, which, he says, is more common in women than men; a circumstance, which he imputes to the ligaments being looser in females, and to the bones of the carpus in them having naturally a greater degree of motion. The tumour increases, when the hand is bent, and diminishes, when it is extended. The case does not produce any serious inconvenience. If the wrist be extended, and pressure be made on the head of the *os magnum*, the reduction is easily accomplished; though a renewal of the displacement cannot be prevented, unless the extension and compression be kept up by means of a suitable apparatus, during the whole time, requisite for the healing of the torn ligaments. As the inconveniences of the accident are slight, few patients will submit to any tedious, irksome treatment; and sometimes the surgeon is never consulted, till it is too late to think of replacing the bone. In general, therefore, the surgeon is obliged to be content with treating the case as a sprain, or contusion.

The connexion of the metacarpal bones with one another, and with those of the carpus, is so close, and the degree of motion so slight, that a dislocation can hardly take place. The first metacarpal bone, which is articulated with the *os trapezium*, and admits of the movements of flexion, extension, abduction, and adduction, is capable of being luxated; but the accident is uncommon for reasons explained in my other work.

Although from the nature of the joint, between the first metacarpal bone and the trapezium, one might infer, that a dislocation is possible in the four directions, backwards, forwards, inwards, and outwards, yet, if we are to believe Boyer, the first case is the only one which has been observed. The accident is produced by the application of external force to the back of the metacarpal bone, which is suddenly and violently thrown into a state of flexion, the case usually arising from a fall on the outer edge of the hand. In this circumstance, the upper head of the bone is forcibly driven backwards, the capsular ligament is lacerated, the extensor tendons of the thumb are pushed up, and the head of the bone slips behind the trapezium.

For an account of the symptoms and treatment of this accident, I must refer to the 4th Ed. of the *First Lines of the Practice of Surgery*, Vol. 2, p. 469.

The first phalanges of the fingers may be dislocated backwards off the heads of the metacarpal bones. A luxation forwards would be very difficult, if not impossible, because the articular surfaces of the metacarpal bones extend a good way forwards, and the palm of the hand makes resistance to such an accident. The first phalanx of the thumb, in particular, is often dislocated backwards, behind the head of the first metacarpal bone, in which case it remains extended, while the second phalanx is bent.

These dislocations should be speedily reduced; for, after eight or ten days, they become irreducible. In a luxation of the first bone of the thumb, which was too old to be easily reduced, and where the part was thrown behind the head of the metacarpal bone, Desault proposed cutting down to the dislocation, and pushing the head of the bone into its place with a spatula. Even in cases, which are quite recent, this kind of dislocation frequently cannot be reduced without the utmost difficulty; and the different proposals which have been made, respecting this particular accident, by Mr. Evans, the late Mr. Hey, Mr. C. Bell, and Boyer, are highly deserving the notice of the surgical practitioner, who will find them explained in my other work. Dislocations of the thumb and little finger inwards, and that of the thumb outwards, (which are possible cases) and luxations of the first phalanges of the other fingers backwards, are all reduced by making extension on the lower end of the affected thumb, or finger, and at the same time pressing the head of the bone towards its natural situation.

After the reduction, the thumb, or finger, affected, should be rolled with tape, and surrounded and supported with pasteboard, till the lacerated ligaments have united; care being taken to keep the hand and forearm quiet in a sling. The luxation of the first phalanx of the thumb, behind the metacarpal bone, requires peculiar treatment, as I have elsewhere explained.

DISLOCATIONS OF THE BONES OF THE PELVIS.

Experience proves, that the bones of the pelvis, notwithstanding the vast strength of their ligaments, may be dislocated by violence; thus, the os sacrum may be driven forwards towards the interior of the pelvis; the ossa ilium may be displaced forwards and upwards; and the bones of the pubes may be totally separated at the symphysis, and an evident degree of moveableness occur between them. For the production of these accidents the operation of enormous force is requisite; and, in fact, their usual causes are falls from a great height; the fall of a very heavy body against the sacrum, at a period when the body is fixed; and the pressure of the pelvis, between a wall, or post, and the wheel of a carriage, or wagon. Hence, the dislocation is generally the least part of the mischief occasioned by such kinds of violence, and the case is commonly attended with concussion of the spinal marrow, injury of the sacral nerves, extravasation of blood in the cellular substance of the pelvis, or cavity of the peritoneum, injury of the kidneys, and fracture of one, or more, of the bones of the pelvis. As Mr. A. Cooper has remarked, some of these cases, complicated with fracture, are liable to be mistaken for dislocations of the thigh: When, says this gentleman, a fracture of the os innominatum happens through the acetabulum, the head of the femur is drawn upwards, and the trochanter somewhat forwards, so that the leg is shortened, and the knee and foot are turned inwards. Such a case, therefore, may be readily mistaken. If the os innominatum is disjoined from the sacrum, and the pubes and ischium are broken, the limb is slightly shorter than the other; but, the knee and foot are not turned inwards. These accidents may generally be detected by a crepitus perceived in the motion of the thigh, when the surgeon applies his hand to the crista of the ilium, and there is greater motion, than in a dislocation of the thigh. (*A. Cooper, Surgical Essays, Part 1, p. 49.*)

In addition to the complications which may attend a dislocation of the bones of the pelvis, and arise immediately from the external violence, the case is always followed by inflammation, which may be very serious, not only on account of the extent of the articular surfaces affected, but because such inflammation may extend to the peritoneum, and viscera of the abdomen and pelvis, as I have myself seen in two or three instances.

Lewis relates a case, in which the os ilium of the right side was found separated from the sacrum, so as to project nearly three inches behind it. This accident was caused by a heavy sack of wheat falling on a labourer. (*Mem. de l'Acad. de Chir. T. 4, 4to.*)

In a case, recorded by Mr. A. Cooper, the posterior part of the acetabulum was broken off, and the head of the thigh-bone had slipped from its socket; the fracture

extended across the innomatum to the pubes, the bones of which were separated at the symphysis nearly an inch asunder. The ilia were separated on each side, and the left os pubis, ischium, and ilium broken. (*Surgical Essays, Part. 1, p. 50.*) In the same work may also be perused another case of fracture of the body of the os pubis and ramus of the ischium; combined with a luxation of the right os innominatum from the sacrum, and laceration of the ligaments of the symphysis of the pubes.

When these cases do not prove fatal from the direct effect of the great violence committed on many parts; or from peritonitis, the same unpleasant event sometimes follows rather later from suppuration of the articular surfaces taking place, and abscesses forming in the cellular membrane of the pelvis. (*Boyer, Traité des Mal. Chir. T. 4, p. 147.*)

A case, in which a dislocation of the left os innominatum upwards had a successful termination, was attended by Enaux, Hoin, and Chaussier, and is published in a modern work. (*Mem. de l'Acad. des Sciences de Dijon.*) As the reduction could not be accomplished at first, antiphlogistic treatment was followed for some days, when new attempts to replace the bone were made, but could not be continued, as they caused a recurrence of pain and other bad symptoms. A third trial, made at a later period, was not more effectual; and all thoughts of reduction were then abandoned. After the patient had been kept quiet some time, though not so long as was wished, he quit- ted his bed, and began to walk about on crutches. I do not understand, however, as is asserted, how the weight of the body could now bring about the reduction, which had been previously attempted in vain. Be this as it may, the result was the patient's recovery. The fact clearly proves, as Boyer observes, that, in cases of this description, the most important object is not to aim at the reduction, but rather to oppose, by every means in our power, inflammation and its consequences. Frequently, the use of the catheter is necessary, and, sometimes an incontinence of urine, or the involuntary discharge of the feces, demands the strictest attention to cleanliness. In these cases, if the patient live any time, there is also another source of danger, consisting in a tendency to sloughing, in the soft parts, on which the patient lies, and which, when they have been bruised, require still greater vigilance.

The os coccygis is not so easily dislocated as fractured. Boyer, however, has seen it displaced in a man, who was greatly emaciated by disease. This subject had considerable ulcerations about the coccyx, and the bone itself was bare. There was an interspace of nearly two inches, between the sacrum and base of the os coccygis. In proportion as the man regained his strength, the bone recovered its right position, and, at length united to the os sacrum, notwithstanding the action of the levatores ani,

which are inserted into it. (*Boyer.*) This case, however, was not an accidental luxation; and it clearly arose from the destruction of the ligaments by disease.

Authors mention two kinds of dislocation, to which the os coccygis is liable; one, inward; the other, outward. The first is always occasioned by external violence; the second, by the pressure of the child's head in difficult labours. Pain, difficulty of voiding the feces and urine, tenesmus, and inflammation, sometimes ending in abscesses, which interest the rectum, are symptoms said to attend and follow dislocations of the os coccygis.

The best authors now regard all schemes for the reduction useless, as the bone will spontaneously return into its place as soon as the cause of displacement ceases; and the introduction of the finger within the rectum, and handling of the painful and injured parts, are more likely to increase the subsequent inflammation, and produce abscesses, than have any beneficial effect. In short, the wisest plan is to be content with enjoining quietude, and adopting antiphlogistic measures.

DISLOCATION OF THE RIBS.

J. L. Petit was silent on this subject, as he thought such cases never occurred. Since his death, a French surgeon, Buttet, has related an instance, which he supposed to be a dislocation of the posterior extremity of the rib from the vertebræ; but Boyer clearly proves, that there were no true reasons for this opinion, and that the case was only a fracture of the neck, or end of the bone, near the spine. (*Traité de Mal. Chir. T. 4, p. 123.*)

Ambrose Paré, Barbette, Juncker, Platner, and Heister, not only admit the occurrence of luxations of the ribs, but describe different species of them. Lieutaud also extended the term luxations to cases, in which the head of the rib is separated by disease, the pressure of aneurisms, &c.

In a modern work may be read the particulars of a case, where all the ribs are said to have been dislocated from their cartilages. The accident arose from the chest being violently compressed between the beam of a mill and the wall. In such a case, there is no means of reduction, except the effect produced by forcible inspirations; nor are there any modes of relief, but bleeding, and the application of a roller round the chest. (*See C. Bell's Surg. Obs. p. 171.*)

DISLOCATIONS OF THE THIGH-BONE.

The head of the thigh-bone may be dislocated upwards on the dorsum of the ilium; upwards and forwards on the body of the os pubis; downwards and forwards on the foramen ovale; and backwards on the ischiatic notch.

The dislocation upwards and backwards, and that downwards and forwards, are the most frequent.

The common kind of dislocation of the thigh-bone upwards, or the dorsum of the ilium, is attended with the following symptoms. The thigh is shorter than its fellow, a little bent, and carried inwards. The knee inclines more forwards and inwards than the opposite one; the leg and thigh are turned inwards, and the foot points in this direction: the toe resting, as Mr. A. Cooper remarks, against the tarsus of the other foot. (*Surgical Essays, Part. 4, p. 27.*) There is an approximation of the trochanter major to the anterior superior spinous process of the ilium, and at the same time it is elevated and carried a little forwards. It is also less prominent, than that on the opposite side, and the natural roundness of the hip has disappeared. The natural length of the limb cannot be restored, without reducing the luxation: the foot, cannot be turned outwards, and any attempt to do so causes pain; but, the inclination of the foot inwards may be increased. (*Boyer.*)

When an attempt is made to draw the leg away from the other, it cannot be accomplished; but the thigh may be slightly bent across its fellow.

A dislocation on the dorsum of the ilium is generally at once readily discriminated from a fracture of the neck of the thigh-bone, within the capsular ligament, by the rotation of the limb inwards; a position, which is unusual in a fracture of any part of the os femoris. "In a fracture of the neck of the thigh-bone (says Mr. A. Cooper) the knee and foot are generally turned outwards; the trochanter is drawn backwards: the limb can be readily bent towards the abdomen, although with some pain; but, above all, the limb, which is shortened from one to two inches by the contraction of the muscles, can be made of the length of the other by a slight extension, and when the extension is abandoned, the leg is again shortened. If, when extended, the limb is rotated, a crepitus can often be felt, which ceases when rotation is performed under a shortened state of the limb. The fractured neck of the thigh-bone, within the capsular ligament, rarely occurs but in advanced age, and it is the effect of the most trifling accidents, owing to the absorption, which this part of the bone undergoes at advanced periods of life. Fractures external to the capsular ligament occur at any age; but, generally in the middle periods of life; and these are easily distinguished by the crepitus, which attends them, if the limb is rotated, and the trochanter is compressed with the hand. The position is the same as in fractures within the ligament. The proportion of fractures of the neck of the thigh-bone, which I have seen, is at least four cases to one of dislocation." (*A. Cooper, Surg. Essays, Part 1, p. 28.*)

To reduce this dislocation, the patient should be placed on his opposite side upon a table firmly fixed, or a large four-posted bedstead. A sheet, folded longitudinally, is first to be placed under the perineum, and

one end being carried behind the patient, the other before him, they are to be fastened to one of the legs, or posts of the bed. Thus the pelvis will be fixed, so as to allow the necessary extension of the thigh-bone to be made. Great care must be taken during the extension to keep the scrotum and testicles, or the pudenda in women, from being hurt by the sheet passed under the perineum. The patient must be further fixed by the assistants.

The best practitioners of the present day in France, advise the extending force to be applied to the inferior part of the leg, in order to have it as far as possible from the parts, which resist the return of the head of the bone into its natural situation. In this country, surgeons generally prefer making the extension by means of a sheet, or the strap of a pulley, fastened round the limb just above the condyles of the os femoris. The direction in which Mr. A. Cooper makes the extension, is in the line made by the limb, when it is brought across the other thigh a little above the knee. As soon as the head of the bone has been brought on a level with the acetabulum by the assistants, who are making the extension, the surgeon is to force it into this cavity by pressing on the great trochanter; or by rotating the knee and foot gently outwards, as practised by Mr. A. Cooper.

The extension should always be made in a gradual and unremitting manner: at first, gently; but afterward more strongly; never violently. The difficulty of reduction arises from the great power and resistance of the muscles, especially the glutei and triceps, which will at length be fatigued, so as to yield to the extending force, if care be taken, that it be maintained the necessary time, without the least intermission. Sometimes, when there is difficulty in bringing the head of the bone over the lip of the acetabulum, Mr. A. Cooper raises it by placing his arm under it near the joint.

The disappearance of all the symptoms, and the noise made by the head of the bone, when it slips into the acetabulum, denote, that the reduction is effected. This noise, however, is not always made when pulleys are used. The bone is afterward to be kept from slipping out again, by tying the patient's thighs together with a bandage placed a little above the knees. The patient should be kept in bed at least three weeks; live low, and rub the joint with a camphorated liniment. Due time must be given for the lacerated ligaments to unite, and the sprained parts to recover; premature exercise may bring on irremediable disease in the joint.

Mr. Hey gives the following description of the way, in which he reduced a case of this kind.

"The extension of the limb must be made in a right line with the trunk of the body; and, during the extension, the head of the bone must be directed outwards as well as downwards. A rotatory motion of the os femoris on its own axis, towards the spine,

(the patient lying prone) seems likely to elevate the great trochanter, bring it nearer to its natural position, and direct the head of the bone towards the acetabulum. These circumstances led to the following method. A folded blanket was wrapped round one of the bed-posts, so that the patient, lying in a prone position, and astride of the bed-post, might have the affected limb on the outside of the bed. The bed was rendered immovable, by placing it against a small iron pillar, which had been fixed for the purpose of supporting the curtain rods. The leg was bent to a right angle with the thigh, and was supported in that position by Mr. Lucas, who, when the extension should be brought to a proper degree, was to give the thigh its rotatory motion, by pushing the leg inwards, that is, towards the other inferior extremity. Mr. Jones sat before the patient's knee, and was to assist in giving the rotatory motion, by pushing the knee outwards at the same moment. I sat by the side of the patient, to press the head of the bone downwards and outwards during the extension. Two long towels were wrapped round the thigh just above the condyles, one towel passing on the inside of the knee, the other on the outside. Three persons made the extension; but when we attempted to give the thigh its rotatory motion, we found it confined by the towel which passed on the inside of the knee and leg. We therefore placed both the towels on the outside; and in this position the extending force concurred in giving the rotatory motion. The first effort that was made, after the towels were thus placed, had the desired effect, and the head of the bone moved downwards and outwards into the acetabulum." (*Hey's Practical Observations*, p. 313.)

For the purpose of facilitating the reduction, many surgeons endeavour to produce a temporary faintness by a copious venesection, immediately before the extension is begun; a practice, which, when the patient's state of health does not forbid it, is advisable, as lessening very materially the resistance of the muscles. Mr. A. Cooper gives it his general approbation, as well as the warm bath, and nauseating doses of tartarized antimony. After taking away from twelve to twenty ounces of blood, this gentleman places the patient in a bath heated to 100 degrees, and gradually raised to 110 degrees, until a faintness is induced. While in the bath, the patient is also to take a grain of tartarized antimony every ten minutes, until nausea is excited, when he is to be removed from the bath, put in blankets, and placed between two strong posts, in each of which a staple is fixed, or he may be placed on the floor, into which two rings may be screwed. The manner in which Mr. A. Cooper performs the reduction with pulleys, having been detailed in the 2d vol. of the *First Lines of Surgery*, I shall not here repeat it. In all cases of difficulty, the above-mentioned debilitating means, the intoxicating effect of a liberal dose of opium, and

the use of pulleys, for the reduction, appear to me to deserve commendation.

Luxations of the thigh bone, downwards and forwards upon the obturator foramen, are the next in frequency to those upon the dorsum of the ilium. The accident is facilitated by the great extent, to which the abduction of the thigh can be carried; by the notch at the inferior and internal part of the acetabulum; by the weakness of the orbicular ligament on this side; and by the ligamentum teres not opposing, nor being necessarily ruptured by it; that is to say, it is only broken, when the head of the femur has been carried with great violence, further from the acetabulum than common. The head of the bone is thrown between the obturator ligament, and obturator externus muscle.

The symptoms are as follows: the injured limb is longer than its fellow, the head of the femur being situated lower than the acetabulum; the trochanter major, which is less prominent than natural, is removed to a greater distance from the anterior superior spinous process of the ilium, and the thigh is flattened, in consequence of the elongation of the head of the muscles. A hard round tumour, formed by the femur, is felt at the inner and superior part of the thigh, towards the perineum. The leg is slightly bent; and the knee and foot, I believe, are generally turned outwards. However, according to Mr. A. Cooper's experience, the foot, though widely separated from the other, is generally turned neither outwards, nor inwards; but, he has seen a little variation in this respect, in different instances. Hence, he prefers as the diagnostic symptoms, the bent position of the body, the separated knees, and the increased length of the limb. (*Essays*, Part 1, p. 37.) The latter symptom alone is a sufficient indication of the accident not being a fracture.

Dislocations on the obturator foramen, are very easy of reduction. The pelvis having been fixed, the extension is to be made downwards and outwards, so as just to dislodge the head of the bone. The muscles then generally draw it into the acetabulum, on the extending force being gradually relaxed, if the upper part of the bone be pulled outward, with a bandage, and the ankle be at the same instant inclined inwards. Thus, the limb is used as a lever, with very considerable power.

Mr. Hey says, that "In this species of dislocation, (downwards and forwards,) as the head of the bone is situated lower, than the acetabulum, it is evident, that an extension made in a right line with the trunk of the body, must remove the head of the bone farther from its proper place, and thereby prevent, instead of assisting, reduction. The extension ought to be made with the thigh at a right angle, or inclined somewhat less than a right angle, to the trunk of the body. When the extension has removed the head of the bone from the external obturator muscle, which covers the great foramen of

the os innominatum, the upper part of the os femoris must then be pushed or drawn outwards; which motion will be greatly assisted by moving the lower part of the os femoris, at the same moment, in a contrary direction; and, by a rotatory motion of the bone upon its own axis, turning the head of the bone towards the acetabulum." (Hey, 316.)

The ensuing case illustrates Mr. Hey's practice.

"The lower bed-post, on the right side of the bed on which the patient lay, was placed in contact with a small immoveable iron pillar (about an inch square in thickness,) such as in our wards are used for supporting the curtain rods of the beds. A folded blanket being wrapped round the bed-post and pillar, the patient was placed astride of them, with his left thigh close to the post, and his right thigh on the outside of the bed. A large piece of flannel was put between the blanket and the scrotum, that the latter might not be hurt during the extension.

"The patient sat upright, with his abdomen in contact with the folded blanket which covered the bed-post. He supported himself by putting his arms round the post, and an assistant sat behind him to prevent him from receding backwards. He was also supported on each side.

"Two long towels were put round the lower part of the thigh, after the part had been well defended from excoriation by the application of a flannel roller. The knot which the towels form, was made upon the anterior part of the thigh, that the motion intended to be given to the leg might not be impeded by the towels.

"The thigh being placed in a horizontal position, or rather a little elevated, with the leg hanging down at right angles to the thigh, I sat down upon a chair, directly fronting the patient, and directed a gentle extension to be made by the assistants standing at my left side. This was done with the view of drawing the head of the bone a little nearer to the middle of the thigh, and the extension had this effect. I then placed the two assistants, who held the towels, at my right side, by which means the extension would be made in a direction a little inclined to the sound limb. Mr. Logan stood on the right side of the patient, with his hands placed on the upper and inner side of the thigh, for the purpose of drawing the head of the bone towards the acetabulum, when the extension should have removed it sufficiently from the place in which it now lay.

"I desired the assistants to make the extension slowly and gradually; and to give a signal when it arrived at its greatest degree. At that moment, Mr. Logan drew the upper part of the bone outwards, while I pushed the knee inwards, and also gave the os femoris a considerable rotatory motion, by pushing the right leg towards the left. By these combined motions, the head of the os femoris was directed upwards and outwards, or, in other words, directly towards the acetabulum,

into which it entered at our first attempt made in this manner.

"The scrotum, as the patient assured me, was not hurt in the least by the extension." (Hey, p. 318.)

The thigh-bone is sometimes luxated upwards and forwards on the pubes. The whole limb is turned outwards, and shortened by one inch; the trochanter major is nearer the anterior superior spinous process of the ilium than natural; the head of the bone forms a tumour in the groin above the level of Poupart's ligament, on the outer side of the femoral artery and vein; and, pressing on the anterior crural nerves, causes great pain, numbness, and even paralysis; and the knee is generally carried backwards.

In the account of the position of the limb, however, authors vary; and, in opposition to what Boyer has stated, Mr. A. Cooper remarks, that there is a slight flexion forwards and outwards. (*Surgical Essays*, Part 1, p. 45.)

The head of the bone felt in the groin, and the impossibility of rotating the limb inward distinguish this case from a fracture of the neck of the bone.

In reducing this dislocation, Mr. A. Cooper recommends the extension to be made in a line behind the axis of the body, so as to draw the thigh-bone backwards; and, when such extension has been continued some time, a napkin is to be put under the upper part of the bone, and its head lifted over the pubes and edge of the acetabulum.

The last dislocation of the thigh remaining to be spoken of, is that backwards.

In this case, according to the valuable description of it given by Mr. A. Cooper, the head of the thigh-bone is placed on the pyriformis muscle, between the edge of the bone which forms the upper part of the ischiatic notch and the sacrosciatic ligament, being behind the acetabulum, and a little above the level of the middle of that cavity. The limb is generally not more than half an inch shorter than its fellow; and the knee and foot are turned inwards, but not nearly in so great a degree as in the dislocation on the dorsum of the ilium. The thigh inclines a little forward, the knee is slightly bent, and the limb is so fixed, that flexion and rotation are in a great measure prevented.

Mr. A. Cooper considers this dislocation as the most difficult, both to detect and reduce: difficult to detect, because the length of the limb, and the position of the knee and foot, are but little changed; difficult to reduce, because the head of the bone is placed deeply behind the acetabulum, and requires to be drawn over the edge of the socket, as well as towards it. In thin subjects, a hard tumour is felt at the posterior and inferior part of the buttock, and the great trochanter is removed further from the spine of the ilium.

The pelvis being fixed, the extension is to be made downwards and forwards, across the middle of the other thigh, so as to dislodge the head of the bone, while the sur-

geon, with a napkin, placed just below the trochanter minor, pulls the upper part of the femur towards the acetabulum. In this case, pulleys are preferable for making the extension.

DISLOCATIONS OF THE PATELLA.

This bone may be luxated outwards, or even inwards, when violently pushed in this direction. The luxation outwards is the most frequent, because the bone more easily slips in this direction off the outer condyle of the femur, than inwards. The assertion made by some authors, that the dislocation inwards is the most common, is quite erroneous, as I have elsewhere more particularly considered. (See *First Lines of Surgery*, Vol. 2.) In confirmation of what has been here observed, I may mention, however, the opinion of Mr. A. Cooper, who states, that the bone is most frequently thrown on the external condyle, where it produces a projection; and this circumstance, with an incapacity of bending the knee, is evidence of the nature of the injury (*Surgical Essays*, Part 1, p. 66.) The generality of cases are easily reduced by pressure, when the extensions of the leg have been completely relaxed; but, owing to a lax state of the ligament of the patella, or other predisposing causes, the bone is sometimes difficultly kept in its proper situation, unless a roller be applied. The inflammatory affection of the joint is to be opposed by bleeding, purging, and the use of the lotio plumbi subacetatis. The joint must be kept quiet a few days, and then gently moved in order to prevent stiffness.

DISLOCATIONS OF THE KNEE.

The tibia may be luxated forward, backward, or to either side; accidents, which may be complete, or incomplete. As Boyer observes, complete dislocations of the upper head of the tibia are exceedingly rare, because the articular surface of the condyles of the femur is so extensive, that the tibia cannot be entirely removed from it, without a prodigious laceration of the ligaments, tendons, and all the rest of the soft parts.

The condyles of the femur are disposed in such a manner, that, in the extreme flexion of the leg, the articular cavities of the upper head of the tibia are still in contact with those bony eminences; and this circumstance, together with the resistance made by the ligament of the patella, the patella itself, and the tendon of the extensor muscles of the leg, renders a sudden dislocation of the tibia backwards so difficult, that Boyer seems even to question the possibility of the accident, notwithstanding the case recited by Heister. (*Traité des Mal. Chir. T. 4, p. 366.*) That this accident, however, sometimes really happens, no longer admits of dispute: the case is noticed by Mr. A. Cooper as producing the following appearances; a shortened state of the limb; a projection of the condyles of the

os femoris; a depression in the situation of the ligament of the patella; and a bending of the leg forwards. This latter statement, I conceive, must be a mistake; and my suspicion is corroborated by Boyer, who declares, that, in the dislocation of the head of the tibia backwards, the leg is bent to a very acute angle, and cannot be extended again. (*Mal. Chir. T. 4, p. 369.*) It appears further, from the particulars of the example of this accident seen by Dr. Walshman, that the dislocation may even be complete, the head of the tibia being thrown behind the condyles of the femur into the ham: The tendinous connexion of the patella to the rectus muscle was ruptured; and, probably, without a laceration of that tendon, or of the ligament of the patella, such a degree of displacement could scarcely have happened (*Surgical Essays*, part 2, p. 74.)

But, if a sudden dislocation of the tibia from the femur backwards is uncommon, the same remark cannot be made respecting a displacement in that direction, gradually produced by the effects of disease. Several cases of the latter kind have fallen under my own observation.

A dislocation of the head of the tibia forwards, from the condyles of the femur, cannot happen without the greatest difficulty; for the accident must be attended with a laceration of the lateral, crucial, and oblique, or posterior ligaments, all which tend to prevent the leg from being too far extended; and, in addition to all this injury, Boyer, calculates, that the heads of the gastrocnemius, the popliteus, and the extensor tendons of the leg, would be immoderately stretched, and even torn. An example of this luxation was seen in Guy's hospital in 1802. According to Mr. A. Cooper, while the tibia projects forward the thigh-bone is depressed, and thrown somewhat laterally, as well as backwards. The os femoris makes such pressure on the popliteal artery, as to prevent the pulsation of the anterior tibial artery on the instep; and the patella and tibia are drawn forwards by the rectus muscle. (*Surgical Essays*, part 2, p. 73.)

Dislocations inwards or outwards, though more frequent than the foregoing cases, are still to be considered as rare, and are always incomplete. In the dislocation inwards, the condyle of the os femoris is thrown upon the external semilunar cartilage, and the tibia projects at the inner side of the joint, so as at once to disclose the nature of the accident; and a depression may be felt under the external condyle. In the luxation of the head of the tibia outwards, the condyle of the os femoris is thrown upon the inner semilunar cartilage, or, as Mr. A. Cooper says, rather behind it. In both these cases, this gentleman thinks, that the tibia is rather twisted upon the os femoris, so that the condyle of the latter bone is thrown somewhat backwards, as well as outwards, or inwards.

I have stated, that lateral luxations of the tibia from the femur are almost always in-

dislocation inwards seems to be established by the 402d Obs. of Lamotte.

Whenever the tibia is dislocated from the femur, the accident has generally happened either while some force was operating upon that bone, at a period when the femur was fixed and immoveable, or else while the thigh-bone was propelled; or twisted with great violence, while the leg itself was firmly fixed.

The bones of the leg are sometimes twisted outward; and the internal lateral ligament ruptured; but this may happen without the crucial ligament being broken. On the other hand, when the bones of the leg are violently twisted inward, the crucial ligaments, and external lateral ligament, must inevitably be ruptured.

These accidents are all most easily reduced, by making gentle extension, and pushing the head of the tibia in the proper direction. The grand object, after the reduction, is to avert inflammation of the knee, and promote the union of the torn ligaments. The first demands the rigorous observance of the antiphlogistic plan—bleeding, leeches, low diet, opening medicines, and a cooling evaporating lotion; both require the limb to remain perfectly motionless. With respect to splints, I conceive, that their pressure would be objectionable. As soon as the ligaments have grown together, and the danger of the inflammation is over, which will be in about three weeks, the joint should be gently bent and extended every day, in order to prevent stiffness. Liniments will now also be of service.

In this section, we must notice the cases, which were first described by the late Mr. Hey, and are named by Mr. A. Cooper partial luxations of the thigh-bone from the semilunar cartilages. Mr. Hey observes, that the disorder may happen either with, or without contusion. When no contusion has occurred, or the effects of it are removed, the joint, with respect to shape, appears uninjured. If there is any difference from its usual appearance, it is that the ligament of the patella seems rather more relaxed than that of the sound limb. The leg is readily bent, or extended by the hands of the surgeon, and without pain to the patient: at most, the degree of uneasiness, caused by this flexion and extension, is trifling. But, the patient himself cannot freely bend, nor perfectly extend the limb in walking; and he is compelled to walk with an invariable and small degree of flexion. Yet, though the leg is stiff in walking, it may be freely moved, while the patient is sitting down.

Mr. Hey ascribes this complaint to any causes which had the effect of hindering the condyles of the os femoris from moving truly in the hollow formed by the semilunar cartilages, and articular depressions of the tibia; an unequal tension of the lateral, or crucial ligaments; or some slight derangement of the semilunar cartilages. (*Pract. Obs. p. 333, ed. 2.*) Mr. A. Cooper says, the most frequent cause of the accident is the point of the foot, while everted, striking against any projection, when pain is

immediately felt in the knee, and the patient becomes incapable of perfectly extending the leg. He has also known the case produced by a person's suddenly turning in bed, and the clothes not suffering the foot to turn as quickly as the rest of the body. A sudden twist of the knee inwards may also displace the semilunar cartilages.

Mr. A. Cooper gives the following explanation of the case. The semilunar cartilages are united to the tibia by ligaments, which, when relaxed, allow the cartilages to be easily pushed from their natural situation by the condyles of the femur, which then come into contact with the head of the tibia; and now, upon an attempt being made to extend the leg, a complete movement of this kind is prevented by the edges of the semilunar cartilages. (*Surgical Essays, Part 2, p. 76.*) In several examples recorded by Mr. Hey, a cure was effected by placing the patient upon an elevated seat, extending the joint, while one hand was placed above the knee, and then suddenly moving the leg backwards, so as to make as acute an angle with the thigh as possible. (*Pract. Obs. p. 337.*) This manoeuvre seems to have the effect of restoring the semilunar cartilages to their natural position. Sometimes, however, it will not answer; and, in one such case, mentioned by Mr. A. Cooper, the patient used to accomplish the reduction by sitting upon the ground, and then bending the thigh inwards and pulling the foot outwards. A knee-cap laced tightly, and furnished with a strong leather strap just below the patella, was requisite in this instance for preventing a return of the displacement. In another case, subject to frequent relapses, these were at length hindered by a bandage with four rollers attached to it, which were tightly applied above and below the patella. (*A. Cooper, Surgical Essays, Part 2, p. 77.*) Compound dislocations of the knee are generally deemed cases demanding amputation.

DISLOCATIONS OF THE FIBULA. ▲

According to Mr. A. Cooper, luxations of the upper head of the fibula, from relaxation of the ligaments, are more frequent than those from violence. The head of the bone is thrown backwards. The bone is easily replaced, but immediately slips behind the tibia again. When the case is attended with disease, repeated blisters are recommended; and, afterwards, a strap to confine the bone in its natural situation. (*Surg. Essays, part 2, p. 105.*) In other instances, a roller, a compress applied over the head of the fibula, and a splint along this bone, would be proper. (*Boyer, Mal. Chir. T. 4, p. 374.*) The latter author has seen a displacement of the whole fibula upwards, accompanying a dislocation of the foot outwards. This case must be exceedingly uncommon, as it is resisted not only by the ligaments of the upper joint of the fibula, but also by those very strong ligamentous complete: but, the possibility of a complete

bands, which bind the malleolus externus to the astragalus and os calcis. In all the cases which I have seen, the pressure of the astragalus, when driven outwards, has broken the fibula. In the instance mentioned by Boyer, the double luxation of the fibula was readily reduced, by rectifying the position of the foot, and bringing the astragalus into its proper place again with respect to the tibia.

DISLOCATIONS OF THE FOOT.

The tibia may be dislocated from the astragalus inwards or outwards; forwards or backwards; and either of these luxations may be complete or incomplete. The dislocation inwards is the most common; the foot being thrown outwards, and its inner edge resting upon the ground, while the fibula is broken about two or three inches above the ankle. Upon dissection, as Mr. A. Cooper observes, the end of the tibia is found resting upon the inner side of the astragalus, and, if the accident has been produced by a jump from a considerable height, the lower end of the tibia, where it is connected to the fibula by ligament, is split off, and remains attached to the latter bone. The broken end of the fibula itself is carried down upon the astragalus, occupying the natural situation of the tibia. The malleolus externus remains in its natural situation, with two inches of the fibula, and the piece of the tibia, which is split off. The capsular ligament, attached to the fibula, and the three strong fibular tarsal ligaments, are uninjured. (*Surgical Essays, Part 2, p. 107.*)

One thing, very essential to be understood in this case, is, that the fracture of the fibula is here the first mischief, without which the dislocation could not have happened. The fibula may easily be fractured without any luxation of the foot, but the above-described dislocation can never take place unpreceded by a fracture of the fibula; and, grave and serious as the displacement of the joint is; it is always a secondary event. (*Dupuytren, Annuaire Med. Chir. 1819, p. 3.*)

It was to this particular case, joined with the fracture of the fibula, that Mr. Pott drew the attention of surgeons, as affording a striking example of the benefit derived from relaxing the muscles; the instance in which, "by leaping or jumping, the fibula breaks within two or three inches of its lower extremity. When this happens, the inferior fractured end of the fibula falls inward towards the tibia, that extremity of the bone which forms the outer ankle is turned somewhat outward and upward, and the tibia having lost its proper support, and not being of itself capable of steadily preserving its true perpendicular bearing, is forced off from the astragalus inwards; by which means the weak bursal, or common ligament of the joint, is violently stretched, if not torn, and the strong ones, which fasten the tibia to the astragalus and os calcis, are always lacerated; thus producing, at

the same time, a perfect fracture and a partial dislocation, to which is sometimes added a wound in the integuments, made by the bone at the inner ankle. By this means, and indeed as a necessary consequence, all the tendons which pass behind or under, or are attached to the extremities of the tibia and fibula, or os calcis, have their natural direction and disposition so altered, that, instead of performing their appointed actions, they all contribute to the distortion of the foot, and that by turning it outward and upward."

When this accident is accompanied, as it sometimes is, with a wound of the integuments of the inner ankle, and that made by the protrusion of the bone, the danger and difficulties of the case are seriously increased.

"By the fracture of the fibula, the dilatation of the bursal ligament of the joint, and the rupture of those which should tie the end of the tibia firmly to the astragalus and os calcis, the perpendicular bearing of the tibia on the astragalus is lost, and the foot becomes distorted; by this distortion the direction and action of all the muscles already recited are so altered, that it becomes (in the usual way of treating this case) a difficult matter to reduce the joint; and, the support of the fibula being gone, a more difficult one to keep it in its place after reduction. If it be attempted with compress and strict bandage, the consequence often is a very troublesome, as well as painful ulceration of the inner ankle, which very ulceration becomes itself a reason why such kind of pressure and bandage can be no longer continued; and if the bone be not kept in its place, the lameness and deformity are such as to be very fatiguing to the patient, and to oblige him to wear a shoe with an iron, or a laced buskin, or something of that sort, for a great while, or perhaps for life.

"All this trouble, pain, difficulty, and inconvenience, are occasioned by putting and keeping the limb in such position as necessarily puts the muscles into action, or into a state of resistance, which in this case is the same. This occasions the difficulty in reduction, and the difficulty in keeping it reduced; this distorts the foot, and by pulling it outward and upward makes that deformity which always accompanies such accident; but if the position of the limb be changed, if by laying it on its outside, with the knee moderately bent, the muscles forming the calf of the leg, and those which pass behind the fibula, and under the os calcis, are all put into a state of relaxation and non-resistance, all this difficulty and trouble do in general vanish immediately; the foot may easily be placed right, the joint reduced, and by maintaining the same disposition of the limb, every thing will in general succeed very happily, as I have many times experienced." (*Pott.*)

I think the profession are much indebted to Mr. A. Cooper, for his application of terms to dislocations of the ankle, which

are liable to no mistake or confusion. Thus, when he speaks of a dislocation of the tibia inwards or outwards, backwards or forwards, the case spoken of is immediately known. On the contrary, when authors write about dislocations of the ankle, or foot, in any named direction, their meaning may be various and misinterpreted. We find this exemplified in Dupuytren's valuable memoir on fractures of the lower end of the fibula; for, instead of terming the above case, a dislocation of the foot outwards, as the generality of writers have done, he thinks it should be named a dislocation of the foot inwards, on account of the direction in which the astragalus is carried. (*Annuaire Med. Chir.* p. 3, 1819.)

With respect to the treatment of the preceding case, Dupuytren admits, that Pott's method easily effects a reduction, though incapable of maintaining it; but, as I have endeavoured in the 2d Vol. of the First Lines of Surgery, to explain the practice recently proposed at the Hôtel-Dieu, it would be useless repetition to enter into the subject again. Mr. A. Cooper appears to prefer the mode of treatment on Mr. Pott's principles; but gives one very essential piece of advice, which is, that the splint, upon which the outer part of the limb rests, may have a foot-piece, "to give support to the foot, prevent its eversion, and preserve it at right angles with the leg. If much inflammation succeeds, leeches are to be applied to the parts, and the constitution will require relief by taking blood from the arm." (*Surgical Essays*, Part 2, p. 108.)

When the tibia is dislocated outwards, the internal lateral ligaments are always ruptured, or pulled away from the bones, and the inner malleolus broken, previously to the fracture of the fibula. On a part of this statement, however, Dupuytren and Mr. A. Cooper differ, as the latter mentions, that the deltoid ligament remains unbroken. In some cases, according to Mr. A. Cooper, the fracture is not confined to the malleolus, but passes obliquely through the articular surface of the tibia, which is thrown forwards and outwards upon the astragalus, in front of the malleolus externus. Sometimes, the astragalus is fractured, and the lower extremity of the fibula broken into several splinters. He states, also, that, when the fibula is not broken, the external lateral ligaments are ruptured. The foot is thrown inwards, its outer edge resting upon the ground; while a considerable projection is made by the malleolus externus under the skin. The accident is generally caused by the passage of the wheel of a carriage over the leg, or a violent twist of the foot inwards in jumping, or falling. (*A. Cooper*, Vol. cit. p. 113.)

The reduction is accomplished by relaxing the muscles of the calf, making extension in the axis of the leg, and pressing the lower head of the tibia inwards towards the astragalus. "The limb is to be laid upon its outer side, resting upon a splint with a

foot-piece, and a pad is to be placed upon the fibula just above the outer angle, and extending a few inches upwards, so as in some measure to raise that portion of the leg, and prevent the tibia and fibula slipping from the astragalus, as well as lessen the pressure of the malleolus externus upon the integuments. (*Surg. Essays*, Part 2, p. 113.) Mr. A. Cooper also enjoins paying the strictest attention to hindering the foot from being twisted inwards, or pointed downwards.

Dupuytren's manner of treating this case, is described in the second Vol. of the First Lines of Surgery.

A complete dislocation of the lower head of the tibia forwards cannot happen, without the fibula being first broken, and either the base of the malleolus internus fractured, or its point torn away. The foot being then acted upon by the extensor and flexor muscles, and unretained by the malleoli and their ligaments, yields to the powerful operation of the muscles of the calf, the astragalus passing behind the tibia, while this projects forward under the tendons and skin of the instep. (*Dupuytren*, *Annuaire Med. Chir.* p. 187, *Atto. Paris*, 1819.) The foot of course is much shortened, the heel lengthened, and firmly fixed, and the toes point downwards. Upon dissection the tibia is found to rest upon the upper surface of the os naviculare, and os cuneiforme internum. The anterior part of the capsular ligament is torn through; the deltoid ligament is only partially lacerated; and the three ligaments of the fibula remain unbroken. (*A. Cooper*, Vol. cit. p. 109.)

This case is much more difficult of reduction, than the instance in which the foot is thrown inwards; and the cause is owing to the powerful manner, in which the muscles resist the extension of the parts, and placing them in their natural position again. As Dupuytren observes, it is true, that such resistance may be lessened by relaxing the muscles, and drawing the patient's attention from his limb, plans which fully answer for the reduction of the other above-mentioned case; yet, in that now under consideration, they are insufficient, and here a greater effort is required to bring the foot from behind forwards, and to place the astragalus under the tibia. And, a still greater difficulty is to keep the parts reduced during the time necessary for the fibula and torn ligaments to be firmly united. In fact, the upper surface of the astragalus, which is convex from behind forwards, is so slippery, that it is hard to make the tibia rest securely on the articular pulley of that bone, which is itself incessantly acted upon by the extensor muscles of the leg, so as to have a tendency to slip behind the lower head of the tibia. In addition therefore to the bent posture, Dupuytren deems it necessary here to employ an apparatus, which propels the foot forward, and the lower head of the tibia backwards. (*Annuaire Med. Chir.* p. 188.) As this apparatus has

been described in the second Vol. of the *First Lines of Surgery*, I need not explain it again.

Mr. A. Cooper prefers keeping the limb upon the heel, resting upon a pillow. A splint, with a suitable pad, and a foot-piece, is to be applied to each side of the leg, care being taken to keep the foot well supported at a right angle with the leg. (*Surgical Essays, Part 2, p. 110.*)

Besides the complete dislocation of the tibia forwards, a partial case is sometimes met with, where one-half of the articular surface of the bone rests upon the os naviculare, and the other on the astragalus. According to Mr. A. Cooper, the fibula is broken; the foot appears but little shortened; nor is there any considerable projection of the heel. The foot points downwards; it cannot be put flat on the ground, and is nearly stiff; and the heel continues drawn up. The accident, if not detected and rectified in its early stage, afterwards admits of no relief, the change in the state of the muscles, and the position in which the fibula has united, not suffering any reduction, even though great force be employed.

Dislocations forwards or backwards, of the tibia, are not common: during fifteen years, Dupuytren has scarcely met with two, or three cases; though he has seen some hundreds of lateral dislocation. It must be obvious to every body, says he, that when the foot is violently bent, or extended, many powerful muscles resist the movement in question, and prevent the mischief, with which the articulation is threatened. (*Annuaire Med. Chir. de Hôpitaux de Paris, p. 34.*) A luxation of the tibia from the astragalus backwards, Mr. A. Cooper has never had an opportunity of observing; a proof of the rarity of the accident.

A luxation of the astragalus, either simple or complicated, with a laceration of the integuments, as Mr. Hey has remarked, is an accident, which does not often occur. Above, the astragalus is articulated with the tibia and fibula; below, it is united, by means of a capsular ligament, to the os calcis; while, in front, it is connected to the os naviculare by a capsular, and broad internal lateral ligament. Thus situated, it is evident, that its displacement is not likely to happen with great frequency; and yet, this observation must be received only as a comparative one; for, the cases of dislocation of the astragalus, now upon record, are rather numerous.

When a dislocation of the lower head of the tibia is combined with one of the astragalus from the os calcis, and os naviculare, and the ligaments, which kept these bones together, are nearly destroyed, while a considerable portion of the astragalus itself protrudes through the wound in the integuments, if it be judged prudent to attempt the preservation of the limb, it is best perhaps to imitate Desault, Ferrand, Trye, and Evans, and extract the astragalus altogether.

A luxation of the astragalus, unattended with a wound in the skin, is a serious and

embarrassing accident; for, in general, the reduction is so difficult, that it is not many years since the case was deemed a ground for amputation. (See *Gooch's Chir. Cases, &c.*) When the displacement in question happens, the astragalus is generally thrown forwards upon the os naviculare, forming a tumour on the instep, and inclining a little either to the outer, or inner side of the foot. In many cases of this description, the reduction is found to be impracticable. Here, as Boyer observes, the impediment does not depend upon the head of the bone being constricted in the narrow opening of the capsule; but rather upon the impossibility of making the extending force, and the pressure of the surgeon's hands, operate with much effect upon the displaced bone. However, an example is recorded by Desault; where the reduction was accomplished by dividing the skin, and then extending the incision through a part of the ligaments. In the *Journal de Chir.* another case is also related of a simple dislocation of the astragalus from the os calcis, and os naviculare, where the reduction was easily performed by common means. Boyer conceives it probable, that, in these cases, most of the ligaments, uniting the astragalus to the os calcis, and os naviculare were ruptured, and that the first of these bones was therefore sufficiently moveable to admit of being replaced by the pressure of the fingers. But, the luxated astragalus may be so wedged between the tibia, os calcis, and os naviculare, that its reduction is impossible, as Boyer has actually seen. In the case, here referred to, things were left to take their course, except that every possible means was employed to keep off inflammation. The result was, that the skin, covering the projection of the astragalus at the inner and upper part of the foot, sloughed, and amputation was at length deemed necessary. (*Mal. Chir. T. 4, p. 400.*) In another case, recorded by Mr. Hey, pressure was made with a tight bandage on the prominence of the astragalus, and the soft parts over it became gangrenous; yet, a recovery followed without amputation, all the projecting portion of the astragalus having gradually come away in fragments. (*Hey's Pract. Obs. p. 384, Ed. 2.*) In an instance, recently published by Dupuytren, a person dislocated the astragalus by alighting with great violence upon the heel, the bone being driven forwards by the pressure, which it had sustained between the tibia and os calcis, so as to form a protuberance under the skin of the instep. As the reduction was found impracticable, a cut was made down to the displaced bone, with the intention of extracting it; but, Dupuytren found, that he could not remove it so readily as he expected; nor yet could he replace it; and, it was not till after a tedious operation, that he succeeded in taking it away. The difficulty arose from the upper surface of the bone being turned downwards, while the back projection of what was naturally the lower part of it took hold of the tibia

in the manner of a hook. (*Annuaire Med. Chir. des Hopitaux de Paris*, 1819, p. 28.)

In another modern valuable publication, two cases of dislocation of the astragalus are related. One was a simple luxation of the astragalus inwards, the os calcis, and the rest of the foot being thrown outwards. The reduction was easily performed by fixing the knee, then extending the foot gently and directly from the leg, by laying hold of the heel with one hand, and placing the other on the dorsum of the foot; and lastly, by pressing the foot inwards, whilst counter-pressure was made with the knee upon the opposite side of the lower extremity of the tibia. The other instance, alluded to, was a compound luxation, in which the astragalus was displaced outwards, and the other tarsal bones thrown inwards. Reduction was accomplished first by bending the leg so as to relax the muscles, and then by extending the foot, as above explained, and rotating it outwards. (*A. Cooper, Surgical Essays*, Part 2, p. 207.)

By heavy weights falling upon the foot, a dislocation is sometimes produced at the transverse joint between the astragalus and os calcis behind, and the os naviculare and os cuboides in front.

Mr. A. Cooper has twice seen the os cuneiforme internum dislocated, and, in both cases, the head of the bone naturally connected to the os naviculare, projected inwards and somewhat upwards, being drawn in this direction by the action of the tibialis anticus muscle. In neither instance was the reduction accomplished; and, in one, the patient had so trivial a lameness, that the functions of the foot were expected to be in time perfect again. (*Surgical Essays*, Part 2, p. 209.)

The phalanges of the toes are sometimes dislocated, and the first bone of the great toe is frequently luxated from the first metatarsal bone; but I am not aware, that these cases are attended with any particular difficulty in the reduction, like some dislocations of the thumb.

On the subject of Dislocations consult *A. Flach, de Luxatione Ossis femoris rariore, frequentiore colli fractura, Disp. Argent.* 1723. *H. Linguet, Quæstio, &c. An in Humeri luxatione ambe potius quam scula, Junia, Poly-spastusque iterato r novata?* Paris, 1732. *E. C. Reichel, Dis. de Epiphysium ab Ossium Diaphysi Diductione, Lips.* 1759. *J. L. Petit, Traité des Maladies des Os*, 1725, et *Traité des Mal. Chir.* 1783; *Duverney Traité des Maladies des Os. Leçons sur les Maladies des Os rédigées en un Traité complet de ces Maladies par Richerand, Tom. 2. Richerand Nosographie Chirurgicale, Tom. 3, p. 193, &c. Edit. 4. Œuvres Chir. Desault, par Bichat, Tom. 1. Pott's Remarks on Fractures and Dislocations, 1775; Kirkland's Observations upon Mr. Pott's General Remarks on Fractures, &c. White's Cases in Surgery. Medical Observations and Inquiries, Vol 2. Bromfield's Chirurgical Cases and Observations, 1773. J. F. P. Castella, Sur les Fracture du Péroné; Landskut, 1808. C. Bell. A System of Operative Surgery, 1809. J. How-*

ship, *Pract. Obs. in Surgery, and Morbid Anatomy*, 8vo. Lond. 1816. *Callissen, Systema Chirurgia Hodierna, Tom. 2. Desault Journal de Chirurgie. Boyer Traité des Mal. Chir. T. 4, Paris, 1814. Trye's Illustrations of some of the Injuries to which the lower limbs are exposed, 30. W. Hey, on Dislocations and internal Derangement of the knee-joint, in Pract. Obs. in Surgery, Ed. 2. Dupuytren, Sur la Fracture de l'Extremité inférieure du péroné, les luxations, et les accidens, qui en sont la suite, in *Annuaire Medico-Chir. des Hospitaux de Paris*, 4to. Paris, 1819. The observations in this memoir are highly interesting, and afford new and instructive views of the subject. G. F. D. Evans, *Pract. Obs. on Cataract, closed Pupil, Amp. at the Shoulder, &c. and Compound Dislocations*, 8vo. Wellington, 1815. *Astragalus removed; shattered end of the fibula sawn off; protruded lower end of the humerus similarly removed; a compound dislocation of the shoulder-joint; and head of the metacarpal bone of the thumb, dislocated, in two instances towards the palm, and, on account of the difficulty of reduction, exposed by an incision, and sawn off.**

DISTICHIA, or DISTICHIASIS. (from *dis*, twice, and *stexis*, a row.) Gorrhæus, Heister, and St. Ives, apply this term to an affection in which each tarsus has a double row of eyelashes, which, inclining inward, irritate the eye, and keep up ophthalmia. Such authors speak of this, as a very frequent complaint; but, the author of the present article in the *Encyclopédie Méthodique, Partie Chirurgicale*, remarks, that he has never met with it at all, though, in ulceration of the eyelids, he has often seen a certain number of the eyelashes incline inward, and cause a good deal of disturbance to the eye, already in a state of inflammation. This disorder cannot properly be called distichiasis. However it may be, all writers recommend plucking out such eyelashes, as assume an unnatural direction. Some of the hairs are first to be taken out one after the other, and a few days are allowed to elapse before the operation is repeated. In order that the eyelashes may be more completely extirpated, and that others may not grow in the same situation, the places from which they grow are usually touched with the argenti nitratum. (See *Trichiasis*.)

DURA MATER, FUNGUS TUMOURS OF. The dura mater, the outer membrane of the brain, was so named by the ancients, on account of its hardness, and its being formerly supposed to be the source of all the other membranes of the body.

Fungus tumours of the dura mater, the true nature of which was ascertained late in the last century, did not escape the notice of the ancient writers; but the disease is very imperfectly described by them, and under an erroneous denomination. They supposed, that the swelling was of the encysted kind, or what they termed *natis, tolpa, testudo*, and that it gradually altered and destroyed the cranium. They sometimes mistook the fungous, or sarcomatous tumour of the dura mater for coagulated blood, or

for ill-conditioned excrescences, like those which make their appearance on ulcers attended with caries. Such are the ideas, which seem to be conveyed by some imperfectly detailed cases in the writings of Lanfranc, Guido di Cauliaco, Theodoricus, and other authors of the thirteenth and fourteenth centuries. Amatus Lusitanus has given the appellation of lupus with caries to a fungous tumour of the dura mater. The swelling occurred in a child eight years old, who died in convulsions, two days after an opening had been made in it.—(*Centur. 5 obs. 8.*) Another similar case, which happened in a child, and was noticed by Camerarius at Paris, is styled a singular bony excrescence. (*Ephemer. curios. natur. decad. 2, ann. 6, 1687, obs. 99.*) Lastly Cattier, a physician of Montpellier, has recorded the history of a lady, who died from the consequences of a fungous tumour of the dura mater. The disease was so acutely painful, as to compel the patient to cry out. The swelling was opened with caustic. Pimprenelle, a Parisian surgeon, recommended the trepan to be employed; but his advice was overruled. After death a fungus of the dura mater, with a perforation in the skull, was detected, and it is described by the author as a hard, stony substance, accompanied with points and asperities. (*Obs. Med. obs. 15, p. 48.*—See *Lassus, Pathologie Chirurgicale, Tom. 1, p. 498. Edit. 1809.*)

The old surgeons, ignorant of the real character of fungous tumours of the dura mater, used often to commit the most serious and fatal mistakes in the treatment. These diseases are of a chronic nature, and make their appearance gradually, in the form of a tumour, which makes its way through the bones of the cranium, rises up, and insensibly blends itself with the integuments, which seem, as it were, to make a part of it. Such fungous tumours of the dura mater may originate spontaneously at any part of this membrane; but they are particularly apt to grow on the surface, which is adherent to the upper part of the skull, or to its basis. They are firm, indolent, and chronic, seeming as if they were the consequence of slow inflammation, affecting the vessels, which supply the dura mater, and insinuate with those of the diploe. It is very difficult, one might say impossible, to determine, whether, in an affection of this kind, the disease begins in the dura mater, or the substance of the bone itself. The general belief, however, is, that the bone is affected secondarily, and that the disorder originates in the dura mater. The patient, who is the subject of the first case, related in a memoir by M. Louis, had received no blow upon the head, and could only impute his complaint to a fall, which he had met with four, or five months previously, and in which the head itself had not received any violence; but, from this time, he experienced a stunning sensation, which continued till he died. The cranium and dura mater were found both equally diseased. Though this case may tend to prove, that fungous tumours of

the dura mater may form spontaneously, yet, it is not the less confirmed by the examination of a vast number of cases, that this affection more frequently follows blows on the head, than any other cause. Hence, a slow kind of thickening of the dura mater is produced, which ends in a sarcomatous excrescence, the formation of which always precedes the destruction of the bone. In the memoir published by M. Louis in the fifth volume, 4to. of those of the Royal Academy of Surgery, there is a very interesting case; illustrating the nature of the present disease.

The subject was a young man, aged twenty-one, who had a considerable tumour on the left side of the head, which was taken for a *hernia cerebri*. (*See this Article.*) The swelling had begun in the region of the temple, and had gradually acquired the magnitude of a second head. The external ear was displaced by it, and pushed down as low as the angle of the lower jaw. At the upper part of the circumference of the base of the tumour, the inequalities of the perforated bone, and the pulsations of the brain, could be distinctly felt. Some parts of the mass were elastic and hard, others were soft and fluctuating. A plaster, which had been applied, brought on a suppuration at some points, from which an ichorous matter was discharged. Shiverings and febrile symptoms ensued, and the man died in less than four months, in the year 1764. On dissection, a sarcomatous tumour of the dura mater was detected, together with a destruction of the whole portion of the skull, corresponding to the extent of the disease.

When a tumour of this nature has decidedly formed, it makes its way outward through all the parts, soft or hard, which are opposed to it. The swelling, in becoming circumscribed, is partly blended with the dura mater, and its pressure produces an absorption of such parts of the skull, as oppose its enlargement. It unexpectedly elevates itself externally, confounding itself with the scalp, and presents itself outwardly in the form of a preternatural, soft, yielding swelling, which even sometimes betrays an appearance of a decided fluctuation, or a pulsation, which may make it be mistaken for an aneurismal tumour. When once the swelling has made its exit from the cavity of the cranium, it expands on every side under the integuments, which readily make way for its growth. The scalp becomes distended, smooth, and œdematous over the extent of the tumour, and lastly it ulcerates. The matter, discharged from the ulcerations, is thin and sanious; the outer part of the tumour is confounded with the integuments and edges of the skull, on which it rests, so that, in this state, it is easy to mistake the tumour for one, whose base is altogether external. While the swelling thus increases in size externally, it also enlarges internally. The latter change takes place in particular, while the opening in the cranium is not large enough to admit the whole mass of the tumour, which then depresses the brain, and

lodges in an excavation, which it forms for itself. But this cavity quickly diminishes, and becomes reduced almost to nothing, as soon as the tumour projects outwardly. The tables of the skull are absorbed to let the swelling arrive externally; but, it is remarked, that the internal, or vitreous table, is always found much more extensively destroyed, than the external one. Sometimes, new bony matter is found deposited around the opening in the cranium.

It is asserted, that, whatever may be the situation of a fungous tumour of the dura mater, the outer layer of this membrane, upon which the disease forms, is alone altered, the inner layer and the pia mater being always unchanged. (*Lassus, Pathologie Chirurgicale, Tom. 1, p. 501. Edit. 1809.*)

In one of these cases, detailed by Walther, the inner layer of the dura mater was quite natural, though one half of the tumour, which was very large, was within the skull, where it had formed for itself a deep excavation in the posterior lobe of the brain. And, what is remarkable, notwithstanding this latter change, the patient, the day before her death, retained all her intellectual faculties, and the power of voluntary motion. (*Journ. für Chirurgie von C. Graefe and Ph. v. Walther, B. 1, p. 64—65, 8vo. Berlin, 1820.*)

According to surgical writers, fungous tumours of the dura mater have been caused by contusions of the skull, falls on the buttocks, concussions of the head or whole body, lues venerea, scrofula, inveterate rheumatism, &c. The three last of the alleged causes, however, seem to be little better than mere conjecture; and the same may be said of Walther's idea, that the disease is of a similar nature to white swelling of the joints, (*Graefe's Journ. B. 1, p. 104.*) beginning rather in the bone, than the dura mater.

Children of the most tender years are even liable to the disease. M. Louis has related, that a child two years of age, died of a fungous of the dura mater, which had produced a swelling above the right ear, attended with a destruction of a portion of the parietal and temporal bones. (*Mém. de l'Acad. de Chirurgie, Tom 5, 4to. p. 31.*)

Though the common opinion is, that these fungi grow entirely from the dura mater, Sandifort asserts, that the vessels of the diploe have a considerable share in their production. (*Descriptio Musei Anat. Acad. Lugd. T. 1, p. 152.*)

A similar belief was entertained by Heister and Kaufmann, and is espoused by Siebold and Walther, the latter imputing the disease to a simultaneous affection of the vessels of the dura mater, and pericranium, attended with an absorption of the earthy part of the bone. (*Journ. für Chir. von C. Graefe, &c. p. 91—93.*)

The existence of a fungous tumour of the dura mater cannot be ascertained, as long as there is no external change. The effects, produced, may originate from so many causes, that there would be great risk of a gross mistake in referring them to any par-

ticular ones. This is not the case, when there is an opening in the skull. Then a hardness, felt from the very first at the circumference of the tumour, denotes that it comes from within. When the swelling is carefully handled, such a crackling sensation is perceived, as would arise from touching dry parchment stretched over the skin. On making much pressure, pain is occasioned, and sometimes a numbness in all the limbs, stupefaction, and other more or less afflicting symptoms. The tumour, in some measure, returns inward, especially, when not very large, and gradually rises up outward again, when the pressure is discontinued. Sometimes, there is pain; at other times, there is none; which may be owing to the manner in which the tumour is affected by the edges of the bone, through which it passes. The pain is often made to go off by compression, but returns as soon as this is taken off. The tumour has an alternate motion, derived from the pulsation of the brain, or of the large arteries at its base. This throbbing motion has led many practitioners to mistake the disease for an aneurism, as happened in the second case related in the memoir of M. Louis. When the tumour is pushed sideways, and the finger carried between it and the edge of the bone, through which the disease protrudes, the bony edge may be felt, touching the base of the swelling, and more or less constricting it. This symptom, when distinguishable, added to a certain hardness and elasticity, and sometimes a facility of reduction, forms a pathognomonic mark, whereby fungous tumours of the dura mater may be discriminated from herniæ of the brain, external fleshy tumours, abscesses, exostoses, and other affections, which at first sight resemble them.

Probably, however, some variety in the symptoms prevails in different instances; for, in the cases recorded by Walther, there was no pulsation, strictly so called, but merely an obscure movement, or an alternate distention and flaccidity, arising from influx of blood into the vessels of the diseased mass; the tumours could not be pushed within the cranium in the slightest degree; nor did the attempt cause any of the effects usually observed to proceed from pressure on the brain. No aperture could be felt in the skull, much less could the irregular edges of the bone around the tumour be distinguished. (*Journ. für Chir. B. 1, p. 57—61, &c. 8vo. Berlin, 1820.*)

Whatever movements also were perceptible in the swellings, Walther is convinced could not be communicated to them by the pulsations of the subjacent brain; because they were wedged, as it were, in an aperture in the skull, and adherent to the dura mater beneath them, and to the superincumbent periosteum, so that, even in the dead subject, they did not admit of being pushed in the least more outwards without difficulty, and the employment of strong pressure. (*Vol. cit. p. 57.*)

Indeed, this tight constriction of the tu-

mour not only explains why stupor, paralysis, &c. were not brought on in these particular examples by external pressure, but also why the edges of the hole in the skull could not be felt; and the small size of the same opening, in relation to the magnitude of the swelling, fully accounts in my opinion for the circumstance of the swellings not sinking inwards under pressure. But, I am far from being convinced with Walther, that fungi of the dura mater are in their nature always irreducible, (see *Vol. cit. p. 82*;) a belief, which he grounds upon the connexion of the diseased mass with the vessels of the diploe; its constriction by the bone; and its expansion under, as well as above, the cranium. Here, I think Walther is as wrong in saying, that none of these fungi can possibly be reduced, as others would be in asserting that it is their invariable character to be reducible. These differences must chiefly depend upon the size of the swelling, in relation to that of the aperture in the skull.

Generally speaking, fungous tumours of the dura mater are very dangerous, as well on account of their nature, as of the difficulty of curing them in any certain manner, and of the internal and external disorder, which they may occasion. Such as have a pedicle, the base of which is not extensive; which are firm in their texture, without much disease in the surrounding bone, are moveable, not very painful, and in persons, who are in other respects quite well, are in general reputed to be the least perilous. These are the cases, in which a cure may be attempted, with a hope of success, though the event is always exceedingly doubtful.

When the contrary of what has been just related occurs, when the disease is of long continuance, and the brain already affected, nothing favourable can be expected.

Compression is the most simple means of cure, and that which has naturally occurred to such practitioners, as have mistaken the disease for an aneurism, or a hernia cerebri. The efficacy of this method has been further misconceived, because the tumour, when not very large, has sometimes been partly, or even wholly reduced, without any bad consequences. This had no little share in leading to errors, concerning the true character of the disease. But, as might be conceived, this reduction, only being attended with temporary success, and having no effect whatever on the original cause of the affection, the symptoms returned, and the tumour rose up again, the moment the compression was discontinued. There is a fact in the memoir of M. Louis, which seems to evince, that good effects may sometimes be produced by compression judiciously employed. A woman, brought to the brink of the grave by the symptoms, occasioned by a tumour of the above kind, having rested with her head, for some time, on the same side as the tumour, found the swelling so suddenly reduced, without any ill effects, that she thought herself cured by some miracle. Compression artfully kept up, by means of a piece of tin, fastened to her cap, prevented the protrusion

of the tumour again. The pressure, however, not having been always very exact, the symptoms every now and then recurred, while the tumour was in the act of being depressed again, and they afterward ceased, on the swelling having assumed a suitable position. The symptoms were, doubtless, occasioned by the irritation, which the tumour suffered, in passing the inequalities around the opening, through which it protruded. The patient lived in this state nine years, having every now and then trances, in one of which, attended with hiccough and vomiting, she perished.

As compression cannot be depended upon, the following safer method may be tried. It consists in exposing the tumour with a knife, which is certainly preferable to caustics, the action of which is very tedious and painful, and can never be limited or extended with any degree of precision. A crucial incision may be made through the scalp covering the tumour, and the flaps dissected up and reflected, so as to bring all the bony circumference into view. Then with trephines repeatedly applied, or with what would be better, Mr. Hey's saws, all the margin of the bone should be carefully removed. Now, if it be true, that the vessels of the diploe are chiefly concerned in the supply of the diseased mass, we see that this source of its growth must be destroyed by the foregoing proceeding.

The tumour, thus disengaged on all sides, may be cut off with a scalpel; and such arteries as bleed much should be tied. Then, instead of applying caustic, as sometimes advised, perhaps, it would be better to remove every part of both layers of the dura mater immediately under the situation of the excrescence. By this means, and the removal of the surrounding bone and diploe, all chance of the regeneration of the tumour would be prevented. In attempting the excision of a fungus of the dura mater, it is certainly an interesting point to know, whether the tumour has an intimate vascular connexion with the diploe, and pericranium, as asserted by Siebold, Walther, and some other respectable authorities; though the importance of the information on this subject to the practitioner is somewhat lessened by his being aware, that it is necessary always to begin with sawing away the bone in the immediate vicinity of the diseased mass. In the dissection of one case, Walther found the pericranium thickened for a considerable extent around the disease, and closely connected with the tumour by vessels. (*Vol. cit. p. 100.*)

When the tumour is sarcomatous, and its pedicle small and narrow, as sometimes happens, one should not hesitate to cut it off.

This method is preferable to tying its base with a ligature, a plan which could not be executed, without dragging, and seriously injuring the dura mater. The excision is also preferable to caustics, which cause great pain, and very often convulsions. In performing the extirpation, we should remove the whole extent of the tumour, and, if possible, its root, even though it may ex-

tend as deeply as the internal layer of the dura mater. This step must not be delayed, for the disease will continue to increase, so as to affect the brain, become incurable, and even mortal. It is to such decision, that we must impute the success, which attended the treatment of the Spaniard Avalos, of whom Marcus Aurelius Severinus makes mention. The above nobleman was afflicted with intolerable headaches, which no remedy could appease. It was proposed to him to trepan the cranium, an operation to which he consented. This proceeding brought into view, under the bone, a fungous excrescence, the destruction of which proved a permanent cure of the violent pains, which the disease had occasioned. It is not mentioned in this case, whether the internal layer of the dura mater was healthy or not; but, there is foundation for believing, that if the extirpation of these tumours be undertaken in time, and bold measures be pursued, as in the instance just cited, success would often be obtained. Indeed, reason would support this opinion; for, when the disease is not extensive, it is necessary to expose a much smaller surface of the dura mater.

It appears to me, however, that trepanning can never be warrantable, unless the disease be indicated by some external changes. I saw my late master, Mr. Ramsden, trepan a man for a mere fixed pain in one part of the head, on the supposition, that there was a tumour under the bone; but no tumour was found, and the operation caused inflammation of the dura mater, and proved fatal.

No doubt, in some cases, the hemorrhage will be considerable, as was exemplified in the instance in which Walther made an incision at the base of one of these fungi, in order to ascertain its nature: two pints of blood being lost from several vessels of very large size ere they could be secured; and the further use of the knife discontinued.

M. Louis has described other tumours, which grow from the surface of the dura mater, when this membrane has been denuded, as after the application of the trephine. They only seem to differ from the preceding cases in not existing before the opening was made in the skull. These cases are not to be confounded with the hernia cerebri. (See this Article.) See on the preceding subject, *Mémoire sur les Tumeurs fungueuses de la Dure-Mère*, par M. Louis, in *Mém. de l'Académie de Chirurgie*, Tom. 5, 4to., or Tom. 13, 12mo. *Encyclopédie Méthodique, Partie Chirurgicale*, art. *Dure-Mère*. J. P. Kaufmann, de *Tumore Capitis fungoso post Cariem Cranii exorto*. *Helmsl.* 1743. Lassus, *Pathologie Chirurgicale*, Tom. 1, p. 497. Edit. 1809. J. and C. Wenzel, *über die Schwammigen Auswuchse auf der äussern Hirnhaut*. *Fol. Mainz.* 1811. In this work, the sentiments of M. Louis are espoused. Ph. v. Walther in *Journ. für Chirurgie von C. Grafe, &c.* B. 1, P. 55, &c. 8vo. Berlin. 1820. The latter writer criticises the opinions of the Wenzels, and, of course, differs considerably from Louis on several points, some of which I have noticed in the foregoing pages.

For an account of inflammation of the dura mater, See *Head, Injuries of*.

E.

EAR, DISEASES OF.

AN organ, so valuable and necessary to the perfection of our existence, as the ear, should have all the resources of surgery exerted for the preservation of its integrity, and the removal of the diseases, with which it may be affected. What, indeed, would have been our lot, if nature had been less liberal, and not endued us with the sense of hearing? As Leschevin has observed, we should then have been ill-qualified for the receipt of instruction; a principal inlet of divine and human knowledge would have been closed; and there being no reciprocal communication of ideas, our feeble reason could never have approached perfection. Even our life itself being as it were dependent upon all such bodies as surround us, would have been incessantly exposed to dangers. The eyesight serves to render us conscious of objects, which present themselves before us, and, when we judge them to be hurtful, we endeavour to avoid them. But, to say nothing of our inability of looking on all sides at once, our eyes become of no service to us, whenever we happen to be enveloped in darkness. The hearing is then

the only sense that watches over our safety. It warns us, not only of every thing which is moving about us, but likewise of noises, which are more or less distant. Such are the inestimable advantages which we derive from this organ. Its importance, when healthy, makes it worthy of the utmost efforts of surgery, when diseased. (Leschevin, in *Mémoires sur les Sujets proposés pour le Prix de l'Acad. Royale de Chirurgie*, Tom. 9, p. 111, 112. Edit. 12mo.)

It is not many years since the diseases of the ear were a subject, on which the greatest ignorance and the most mistaken opinions prevailed; and, indeed, how could any correct pathological information be expected, while anatomists had not given a complete and accurate description of the organ itself? Also, notwithstanding what has now been made out, respecting disorders of the ear, it is generally admitted, that they still require further investigation, and renewed industry. Though Duverney, Valsalva, Morgagni, &c. dispelled some of the darkness, which covered this branch of surgery, they left a great deal undone. Since their time, science has been enriched with the valuable discoveries of Cotunni, Meckel,

Scarpa, and Compagetti; the two first of whom demonstrated, that the labyrinth is filled with a limpid fluid, and not (as was pretended) with confined air; while the two last distinguished anatomists favoured the public with the first very accurate description of the parts composing the labyrinth, especially the semicircular canals.

In 1763, the French Academy of Surgery offered a prize for the best essay on diseases of the ear, and, two years afterwards the honour was adjudged to that of Leschevin, senior surgeon of the hospital at Rouen. This memoir is still of great value, few modern treatises being more complete. The most useful contributors to our stock of information on the Pathology of the ear, subsequently to M. Leschevin, have been Kritter, and Lentin (*Ueber das Schwere Gehoer. Leipz. 1794.*;) Trampel (*Armenian's Magaz. B. 2, 1798.*;) Pflingsten (*Vieljahrige Erfahrung ueber die Gehoerfehler, Kiel, 1802.*;) Alard (*sur le Catarrhe de l'Oreille, 8vo. Paris, 1807, 2d Edit.*) Mr. A. Cooper, (*Phil. Trans. 1802.*) Portal (*Anat. Med. 1803.*;) J. C. Saunders, (*Anat. and Dis. of the Ear, 1806.*) Baron Boyer (*Mal. Chir. T. 6.*) Saissy, in an essay, which received the approbation of the Medical Society of Bordeaux; and Professor Rosenthal in a short but sensible tract on the pathology of the ear. (See *Journ. Complem. T. 6, 1820.*)

But, notwithstanding the laudable endeavours of so many men of eminence, the pathology of the internal ear, and the treatment of its diseases, are far, I may say, very far from a high state of improvement. To further advances, indeed, some discouraging obstacles present themselves: the auditory apparatus is extremely complicated; the most important parts of it are entirely out of the reach of ocular inspection; the anatomy of the organ is perhaps not yet completely unravelled; the exact uses and action of several parts of it, anatomically known, are still involved in mystery; the opportunities of dissecting the ear in a state of disease are neither frequent, nor duly watched, and even when they are taken, and when vestiges of disease, or imperfection, are traced to particular parts of the organ, the utmost difficulty is experienced in drawing any useful practical conclusion, because the natural uses of those parts, and the precise manner in which they contribute to the perfection of the ear, are not known to the most enlightened physiologists. We are here nearly in the same helpless dilemma, as a watchmaker would be, were he, in examining the interior of a watch, to find parts broken and out of order, the exact uses of which, in the perfection of the instrument, he had not first studied and comprehended. In fact, the physiology of the ear is but very imperfectly understood; and, as Rosenthal remarks, (*Journ. Complem. T. 6, p. 17.*) if, notwithstanding the progress made in optics, and the complete knowledge of the structure of the eye, a perfect explanation has not yet been given of the phenomena of this organ, as an

instrument of vision, we cannot wonder, that, with far more circumscribed information about acoustics, and the greater difficulty of unravelling the structure of the ear, so little progress should have been made in the physiology of the latter organ. Were it practicable in acoustics to arrive at that precision and certainty, which would enable us to establish laws in the theory of sound, as fixed as those which relate to light, this void in physiological science might perhaps be obviated. But, Rosenthal justly argues, that hitherto the approach to perfection has not been made, and this notwithstanding the learned and valuable labours of Chladni. (*Akustik. 4to. Leipz. 1802.*) Some facts, however, are admitted to be well ascertained, and the researches of Autenrieth and Kerner (*Reil's Archiv. fur die Physiol. T. 9, p. 313—376.*) are honourably mentioned; for, though they only elucidate the function of the conductor-part of the ear, they are of unquestionable importance to the medical practitioner. It is clearly proved, that the difference in the length and breadth of the meatus auditorius, the form of the membrana tympani, and the make of the cavity of the tympanum, modify sound; that is to say, that the differences of structure of the auricle and meatus auditorius externus, which merely receive and concentrate the sonorous undulations, as these emanate from a vibrating body, can only influence the degree of force, or weakness of the sound; while, on the contrary, the differences of structure in the membrane and cavity of the tympanum are not limited to this effect, but the greater or less tension of the one, and the more or less considerable capacity of the other, appear to alter in greater or lesser degree the particular character of the sound. (*Journ. Complem. T. 6, p. 20.*)

1. Wounds and Defects of the External Ear.

The external ear, which is a sort of instrument calculated for concentrating the undulations or waves of sound, may be totally cut off, without deafness being the consequence. For a few days after the loss, the hearing is rather hard; but the infirmity gradually diminishes, the increased sensibility of the auditory nerve compensating for the imperfection of the organic apparatus. (*Richerand Nosogr. Chir. T. 2, p. 122, Edit. 2.*)

Dr. Hennen says, that he has met with a case, where the external ear was completely removed by a cannon shot, and yet the sense of hearing was as acute as ever. (*Principles of Military Surgery, p. 348, Ed. 2.*) Another case, recorded by Wepfer, also proves, that a total loss of the auricle may not cause any material injury of hearing, for the patient of whom he speaks had had the whole of the external ear destroyed by ulceration, and yet could hear as well as before the loss. (*Kritter und Lentin Ueber das schwere Gehoer, p. 19, Leipz. 1794.*) However, if we are to credit the statement of other writers, the recovery is generally far less complete. Thus Leschevin notices, that they who have lost the external ear, or have it naturally too flat,

or ill shaped, have the hearing less fine. The defect can only be remedied by an artificial ear, or an ear trumpet, which, receiving a large quantity of the sonorous undulations, and directing them towards the meatus auditorius, thus does the office of the external ear. (*Priz. de l'Acad. Royale de Chir. T. 9, p. 120, Édit. 12mo.*)

Wounds are not the only causes, by which the external ear may be lost: its separation is sometimes the consequence of ulceration, and sometimes the effect of the bites of horses and other animals. In cold climates, it is frequently frozen, and afterwards attacked with inflammation and sloughing. When the external ear is not totally separated from the head, the surgeon should not despair of being able to accomplish the reunion of it. This attempt should always be made, however small a connexion the part may have with the skin; for, in wounds of this kind, the efforts of surgery have occasionally succeeded beyond all expectation.

Wounds of the external ear, whatever may be their size and shape, do not require different treatment from that of the generality of other wounds. The reunion of the divided part is the only indication, and it may be in most instances easily fulfilled by means of methodical dressings. Such writers, as have recommended sutures for wounds of the ear, (says Leschevin,) have founded this advice upon the difficulty of applying to the part a bandage, that will keep the edges of the wound exactly together. The cranium, however, affords a firm and equal surface, against which the external ear may be conveniently fixed. Certainly, it is not more easy to secure dressings on the nose than the ear; and yet, cases are recorded, in which the cartilaginous part of the nose was wounded, and almost entirely separated, and the union was effected without the aid of sutures. (See *Mém. de M. Pibrac sur l'Abus des Sutures*, in *Mem. de l'Acad. de Chir. Tom. 3.*)

In wounds of the ear, then, we may conclude, that sutures are generally useless and unnecessary. As examples may occur, however, in which the wound may be so irregular and considerable as not to admit of being accurately united, except by this means, it should not be absolutely rejected. An enlightened surgeon will not abandon altogether any curative plans; he only points out their proper utility, and keeps them within the right limits. When sticking plaster, simple dressings, and a bandage, that makes moderate pressure, appear insufficient for keeping the edges of a wound of the ear in due contact, the judicious practitioner will not hesitate to employ sutures.

When a bandage is applied to the external ear, it should only be put on with moderate tightness, since much pressure gives considerable uneasiness, and may induce sloughing. In order to prevent these disagreeable effects, Leschevin advises us to fill the space behind the ear with soft wool or cotton, against which the part may be compressed without risk. (*Op. cit. p. 119.*)

Baron Boyer remembers a medical stu-

dent, who was compelled by an ulcer on the sacrum to lie for a long time on his side, in which posture the pressure on the ear caused a slough of the antihelix, and after the separation of the dead part, an aperture, large enough to receive the end of the little finger, was left in the pinna or auricle.

In the application of sutures to the ear, the ancients caution us to avoid carefully the cartilage, and to sew only the skin. They were fearful that pricking the cartilage would make it mortify, "*ce qui est souvent-fois arrivé*," says Paré. But notwithstanding so respectable an authority, as Leschevin has remarked, the moderns make no scruple about sewing cartilages. In wounds of the nose, Verduc expressly directs the skin and cartilage to be pierced at once, and the success of the plan is put out of all doubt by a multitude of facts. The same treatment may also be safely extended to the ear.

Celsus, lib. 8, c. 6, speaks of fractures of the cartilage of the ear; but, such an accident seems hardly possible, unless the part be previously ossified. Leschevin and Boyer have never met with such a case, either in practice, or in the works of surgical writers.

In this section, a few malformations of the external ear require notice. Sometimes the orifice of the meatus auditorius is diminished by the tragus, antitragus, and antihelix being depressed into it. Here the excision of these wrongly-formed eminences has been recommended, as a surer means of perfecting the sense of hearing, than the use of any tube, or dilating instruments. The tragus has been known to project considerably backwards, and to apply itself most closely over the orifice of the meatus, which was also a mere slit, instead of a round opening. In one case of this description, relief was obtained by the introduction of tubes, calculated to maintain the tragus in its proper position. (*Dict. des Sciences Med. T. 38, p. 28.*)

Sometimes the outer ear is entirely wanting. Thus Fritelli has given an account of a child in this condition, whose physiognomy at the same time strongly resembled that of an ape. (*Orteschi Giorn di Med. T. 3, p. 80.*) Oberteuffer has also recorded an example of a total deficiency of the auricles in an adult, who yet heard very well. (*Stark's Neues Archiv. B. 2, p. 638. J. F. Meckel Handbuch der Pathol. Anat. B. 1, p. 400, Leips. 1812.*)

Many years ago, I remember a child, which was shown to several medical gentlemen in London, as a curiosity; it was entirely destitute of all appearance of external ears, and no vestiges of the meatus auditorii could be seen, these openings being completely covered by the common integuments. Yet the child could hear a great deal, though the sense was certainly dull and imperfect. I remember that the circumstance of the patient hearing so well as he did, was what excited considerable surprise. I am sorry I do not more particularly recollect, at the

present time, the degree in which this sense was enjoyed, and several other circumstances, such as the child's age, power of speech, &c. The example, however, is interesting, inasmuch as it proves, that even a deficiency of the auricles, combined with an imperforate condition of both ears, may be unattended with complete deafness, provided the internal and more essential parts of these organs are sound and perfectly formed.

Baron Boyer attended a young man; the lobule of one of whose ears extended in a very inconvenient manner over the cheek: the redundant portion was removed with a pair of scissors, and the wound soon healed.

The auricle, not being a very irritable part, is not often inflamed, and when it is so, the affection is generally of an erysipelatous character. Portal has seen the part nearly an inch thick; and he takes notice of the prodigious thickness, which the lobe of the ear sometimes acquires in women, who wear very heavy ear-rings, which keep up constant irritation. Small encysted and adipose swellings occasionally grow under the skin of the external ear, and demand the same treatment as swellings of the same nature in other situations. (See *Tumours*.) Lastly, the external ear is frequently the seat of scrofulous, and other ill-conditioned ulcers. These cases generally require cleanliness, alterative medicines, and to be dressed with the ung. hydrarg. nitrat. or a solution of the nitrate of silver; and sometimes when the sores resist for a long time the effects of medicine and the usual dressings, they will soon heal up, if the treatment be assisted with a blister, or seton, kept open on the nape of the neck. (See *Dict. des Sciences Med.* T. 38, p. 28, 29.)

2. Of the Meatus Auditorius, and its Imperfection.

This is the passage, which leads from the cavity of the external ear, called the concha, down to the membrane of the tympanum. It is partly cartilaginous, and partly bony, and has an oblique winding direction, so that its whole extent cannot be easily seen. There are circumstances, however, in which it is proper to look as far as possible into the passage. Such is the case, when the surgeon is to extract any foreign body, to remove any excrescence, or to detect any other occasion of deafness. Fabricius Hildanus gives a piece of advice upon this subject, not to be despised; namely, to expose the ear to the rays of the sun, in order to be enabled to see the very bottom of the meatus auditorius externus.

The surgical operations practised on the meatus auditorius are confined to opening it, when preternaturally closed, extracting foreign bodies; washing the passage out with injections, and removing excrescences, which may form there.

The case which we shall next treat of, is the imperforation of the meatus auditorius externus, a defect with which some children are born.

When the malformation exists in both

ears, it generally renders the subject dumb, as well as deaf, for, as he is incapable of imitating sounds, which he does not hear, he cannot of course learn to speak, although the organs of speech may be perfect, and in every respect rightly disposed. In this case, the surgeon has to rectify the error of nature, and, (to use the language of Leschevin,) he has to give by a double miracle, hearing and speech to an animated being, who, deprived of these two faculties, can scarcely be regarded in society as one of the human race. How highly must such an operation raise the utility and excellence of surgery in the estimation of the world!

When the meatus auditorius externus is merely closed by an external membrane, the nature of the case is evident, and the mode of relief equally easy. But, when the membrane is more deeply situated in the passage, near the tympanum, the diagnosis is attended with more difficulty, and the treatment with greater trouble.

If the preternatural membrane is external, or only a little way within the passage, it is to be divided with a bistoury; the small flaps are to be cut away; a tent, of a suitable size, is to be introduced into the opening; and the wound is to be healed *secundum artem*, care being taken to keep it constantly dilated, until the cicatrization is completed.

When the obstruction is deeply situated, we must first be sure of its existence, which is never ascertained, or even suspected, till after a long while. It is not till after children are past the age, at which they usually begin to talk, that any defect is suspected in the organ of hearing, because until this period, little notice is taken, whether they hear or not. As soon as it is clear, that this sense is deficient, the ears should always be examined with great attention, in order to discover, if possible, the cause of deafness. Sometimes, the infirmity depends upon a malformation of the internal ear, and the cause does not then admit of detection. The most convenient method of making the examination is to expose the ear, which is about to be examined, to the light of the sun. In this situation, the surgeon will be able to see beyond the middle of the bony part of the meatus, if he places his eye opposite the orifice of the passage, and takes care to efface the curvature of the cartilaginous portion of the canal, by drawing upward the external ear. If the passage has been carefully cleansed, before the examination, the skin, forming the obstruction, may now be seen, unless it be immediately adherent to the tympanum.

When the preternatural septum is not closely united to the tympanum, its destruction should be attempted, and hopes of effecting the object, either suddenly, or gradually, may reasonably be entertained. According to Leschevin, the particular situation of the obstruction is the circumstance, by which the surgeon ought to be guided in making a choice of the means for this operation. If the membranous partition is so

far from the tympanum, that it can be pierced without danger of wounding the latter part, there can be no hesitation in choosing the plan to be adopted. In the contrary state of things, Leschevin is an advocate for the employment of caustic, not only on account of the risk of injuring the tympanum with a cutting instrument, but, also, because, if the puncture were ever so well executed, a tent could not be introduced into it, so as to prevent it from closing again.

In the first case, a very narrow sharp-pointed bistoury should be used: after its blade has been wrapped round with a bit of tape to within a line of the point, it is to be passed perpendicularly down to the preternatural membrane, which is to be cut through its whole diameter. The instrument being then directed first towards one side, then the other, the crucial incision is to be completed. As the flaps, which are small and deeply situated, cannot be removed, the surgeon must be content with keeping them separated by means of a blunt tent. The wound will heal just as favourably as that occasioned in removing the imperforation of the concha, or outer part of the meatus auditorius. (*Prix de l'Acad. de Chir.* p. 124—126, T. 9.) In the second case, that is to say, when the risk of wounding the tympanum leads us to prefer the employment of caustic, the safest and most commodious way of putting the plan in execution would be that of touching the obstruction, as often as circumstances may require, with the extremity of a bougie armed with the *argentum nitratum*. In the intervals of the applications, no dressings need be introduced, except a bit of clean soft cotton, for the purpose of absorbing any discharge, which may take place within the passage.

It is manifest, that if the whole, or a considerable part of the meatus auditorius externus were wanting, the foregoing measures would be insufficient. The following observations of Leschevin merit attention: "I do not here allude to cases, in which a malformation of the bone exists. I know not, whether there are any examples of such an imperforation; but, it is clear, that it would be absolutely incurable. I speak of a temporal bone perfectly formed in all its parts, and the meatus auditorius of which, instead of being merely lined by a membrane, as in the natural state, is blocked up by the cohesion of the parietes of this membrane throughout a certain extent of the canal; just as the urethra, rectum, or vagina, is sometimes observed to be not simply closed by a membrane, but by a true obliteration of its cavity.

"Such a defect in the ear may be congenital, and it may also arise from a wound, or ulceration, of the whole circumference of the meatus auditorius externus, this canal having become closed by the adhesion of its parietes, on cicatrization taking place.

"Such an imperforation, whether congenital or accidental, must certainly be more difficult to cure, than the examples

treated of above; but, (says Leschevin) I do not for this reason believe, that the case ought to be entirely abandoned. Yet, I would not have the cure attempted in all sorts of circumstances. For instance, if the defect only existed in one ear, and the other were sound, I would not undertake the operation, because, as the patient can hear tolerably well on one side, the advantages which he might derive from having the enjoyment of the other ear, would not counterbalance the pain and bad symptoms occasioned by such an experiment, the success of which is extremely uncertain. I would not then run the risk of making a perforation, except in a case of complete deafness; and I propose this means only as a dubious one upon the fundamental maxim, so often laid down, that it is preferable to employ a doubtful remedy, than none at all.

"With respect to the mode of executing this operation," says Leschevin, "the trocar seems the most eligible instrument. I would employ one, that is very short, and the point of which is bluntish, and only projects out of a cannula as little as possible. This construction would indeed make the instrument less adapted to pierce any thing; but, still, as the parts to be perforated are firm, their division might be accomplished sufficiently well; and the inconvenience of a trivial difficulty in the introduction of the trocar is comparatively much less, than that which would attend the danger of wounding with a sharper point the membrane of the tympanum. I would plunge the point of the instrument into the place, where the opening of the meatus auditorius externally ought naturally to be, and which would be denoted, either by a slight depression, or at all events by attending to the different parts of the ear, especially the tragus, which is situated directly over this passage. I would push in the trocar gently, in the direction of the canal formed in the bone, until the point of the instrument felt as if it had reached a vacant space. Then, withdrawing the trocar, and leaving the cannula, I would try whether the patient could hear. I would then introduce into the cavity of the cannula itself a small, rather firm tent, of the length of the passage, or a small bougie. By means of a probe, I would push it to the end of the cannula, which I would now take out, observing to press upon the tent, which is to be left in. The rest of the treatment consists in keeping the canal pervious, making it suppurate, and healing it with common applications. One essential caution, however, would be that of keeping the part dilated long after it had healed: otherwise, it might close again, and a repetition of the operation become necessary. This happened to Heister, as he himself apprizes us, and it occurred to Roonbuysen in treating imperforations of the vagina.

"If the cohesion of the parietes of the meatus auditorius externus were to extend to the tympanum inclusively, the operation would be fruitless; but, as it is impossible

to ascertain this circumstance, before the attempt is made, the surgeon would incur no disgrace by relinquishing the operation, and giving up the treatment of an incurable disease. If, then, after the trocar were introduced to about the depth of the tympanum, the situation of which must be judged of by our anatomical knowledge, no cavity were met with, the operation should be abandoned; and, if in these circumstances, any one were to impute the want of success to the inefficacy of surgery, or the unskilfulness of the surgeon, he would act very unfairly.

"It is also plain, that such an operation could cure a congenital deafness, only inasmuch as it might depend upon the imperforation; for, if there should exist, at the same time, in the internal ear, any malformation, destructive of the power of the organ, the remedying of the external defect would be quite useless." (*Leschevin, in Prix de l'Acad. de Chirurgie, Tom. 9, p. 127, 132.*)

We find, that this author entertains a great dread of wounding the tympanum, and certainly he is right in generally insisting upon the prudence of avoiding such an accident. It will appear, however, in the sequel of this article, that under certain circumstances, puncturing the tympanum has been successfully practised, as a mode of remedying deafness. The operation, however, demands caution; for, if done so as to injure the connexion of the malleus with the membrana tympani, the hearing must ever afterward be very imperfect.

3. Unusual smallness of the Meatus Auditorius Externus.

Imperforation is not the only congenital imperfection of the meatus auditorius; this passage is occasionally too narrow for the admission of a due quantity of the sonorous undulations, and the sense is of course weakened. Leschevin mentions, that M. de la Metrie found this canal so narrow in a young person, that it could hardly admit a probe. What has been observed, concerning the imperforation, is also applicable to this case. If it depends upon malformation of the bone, it is manifestly incurable; but, if it is owing to a thickening of the soft parts, within the meatus, hopes may be indulged of doing good by gradually dilating the passage by tents, which should be increased in size from time to time, and, lastly, making the patient wear for a considerable time, a tube, adapted to the part in shape. (*Leschevin, in Prix de l'Acad. de Chirurgie, Tom. 9, p. 132.*)

Mr. Earle has lately published a case, in which the diameter of the meatus auditorius was considerably lessened by a thickening of the surrounding parts, and especially of the cuticle, attended with a discharge from the passage, and great impairment of hearing. A cure was effected by injecting into the passage a very strong solution of the nitrate of silver, which in a few days, was followed by a detachment of the thickened portions of cuticle. This evacuation was assisted by throwing warm water into

the passage. (*See Med. Chir. Trans. Vol. 10, p. 411, &c.*) Boyer was consulted for a deafness, which arose from a malformation, which consisted of a flattening of the meatus, its opposite sides being for some extent in contact. The patient was advised to wear in the ear a gold tube of suitable shape, by which means he was enabled to hear perfectly well.

4. Faulty shape of the Meatus Auditorius Externus.

Anatomy informs us, that this passage is naturally oblique, and somewhat winding; and natural philosophy teaches us the necessity of such obliquity, which multiplies the reflections of the sonorous waves, and thereby strengthens the sense. This theory, says Leschevin, is confirmed by experience; for, there are persons, in whom the meatus auditorius is almost straight, and they are found to be hard of hearing. If there is any means of correcting this defect, it must be that of substituting, for the natural curvature of the passage, a curved and conical tube, which must be placed at the outside of the organ, just like a hearing trumpet. The acoustic instrument, invented by Deckers, which is much more convenient, might also prove useful. (*Op. cit. p. 133.*)

5. Extraneous Substances, Insects, &c. in the Meatus Auditorius Externus.

Foreign bodies met with in this situation are inert substances, which have been introduced by some external force; insects, which have insinuated themselves into the passage; or the cerumen itself, hardened in such a degree as to obstruct the transmission of the sonorous undulations. Worms, which make their appearance in the meatus auditorius, are always produced subsequently to ulcerations in the passage, or in the interior of the tympanum, and, very often, such insects are quite unsuspected causes of particular symptoms. In the cases of surgery, published in 1778, by Acrel, there is an instance confirming the statement just offered. It is the case of a woman, who, having been long afflicted with a hardness of hearing, was suddenly seized with violent convulsions, without any apparent cause, and soon afterward complained of an acute pain in the ear. This affection was followed by a recurrence of convulsions, which were still more vehement. A small tent of fine linen, moistened with a mixture of oil and laudanum, was introduced into the meatus auditorius, and, on removing it the next day, several small round worms were observed upon it, and, from that period, all the symptoms disappeared. To this case, we shall add another from Morgagni. A young woman consulted Valsalva, and told him, that when she was a girl, a worm had been discharged from her left ear; that another one, about six months ago, had also been discharged, very much like a small silkworm in shape. This event took place after very acute pain in the same ear, the forehead and temples. She added, that

since this, she had been tormented with the same pains, at different intervals, and so severely, that she often swooned away for two hours together. On recovering from this state, a small worm was discharged, of the same shape as, but much smaller than, the preceding one, and she was now afflicted with deafness and insensibility on the same side. After hearing this relation, Val-salva no longer entertained any doubt of the membrane of the tympanum being ulcerated. He proposed the employment of an injection, in order to destroy such worms as yet remained. For this purpose, distilled water of St. John's wort, in which mercury had been agitated, was used. In order to prevent a recurrence of the inconvenience, Morgagni recommends the affected ear to be closed up when the patient goes to sleep, in autumn and summer. If this be not done, flies, attracted by the supuration, enter the meatus auditorius, and, while the patient is unconscious, deposit their eggs in the ear. Acrel, in speaking of worms, generated in the meatus auditorius observes, that there is no better remedy for them, than the decoction of ledum palustre, injected into the ear, several times a day. However, as this plant cannot always be procured, an infusion of tobacco in oil of almonds may be used, a few drops of which are to be introduced into the ear, and retained there by means of a little bit of cotton. This application, which is not injurious to the lining of the passage, is fatal to insects, and especially to worms. It will answer in cases where caterpillars, ants, earwigs and other insects have insinuated themselves into the meatus auditorius; though it is generally considered better first to endeavour to extract them. A piece of lint, smeared with honey, often suffices for this purpose, and when they cannot be extracted by this simple means, they may be taken out with a small pair of forceps. The latter method serves also for the extraction of cherry-stones, peas, or other seeds which have been introduced into the meatus auditorius. If such substances should make too much resistance, forceps with stronger blades for breaking the extraneous bodies must be employed, and then the fragments are to be extracted piecemeal. But, in these cases, before attempting the extraction, a little oil of almonds should be injected. The presence of foreign bodies in the ear often occasions the most extraordinary symptoms, as we may see in the fourth observation of Fabricius Hildanus, Cent. 13.

After four surgeons, who had been successively, consulted had in vain exerted all their industry to extract a bit of glass from the left ear of a young girl, the patient found herself abandoned to the most excruciating pain, which soon extended to all the side of the head, and which, after a considerable time, was followed by a paralysis of the left side, a dry cough, suppression of the menses, epileptic convulsions, and, at length, an atrophy of the left arm. Hildanus cured

her, by extracting the piece of glass, which had remained eight years in her ear, and had been the cause of all this disorder. Although the extraction must have been very difficult, it does not appear that Hildanus found it necessary to practise an incision behind the ear, as some authors have advised, and among them, Duverney, who has quoted the foregoing case. We must agree with Leschevin, that such an incision does not seem likely to facilitate the object very materially; for, it must be on the outside of the extraneous substance, which is in the bony part of the canal. The incision enables us, in some measure, to avoid the obliquity of the passage, as Duverney has observed; but it is not such obliquity of the cartilaginous portion of the canal, that can be a great impediment; for, as it is flexible, it may easily be made straight, by drawing upwards the external ear. Hence, Fabricius ab Aquapendente rejected this operation, first proposed by Paulus Ægineta; and it is justly disapproved of by Leschevin. (*Prix de l'Acad. de Chir. Tom. 9, p. 147, Edit. 12mo.*)

Sabatier relates a case, in which a paper ball, which had been pushed into the meatus auditorius, made its way by ulceration into the cavity of the tympanum, where an abscess formed, which communicated with the interior of the cranium. (*Dict. des Sciences Med. T. 7, p. 8.*)

6. Meatus Auditorius obstructed with thickened, or hardened Cerumen.

The cerumen, secreted in the meatus auditorius by the sebaceous glands, frequently accumulates there in large quantities, and becoming harder and harder, at length acquires so great a degree of solidity as entirely to deprive the patient of the power of hearing. Galen has remarked, *è numero eorum quæ meatum obstruunt, sordes esse quæ in auribus colligi solent*. This species of deafness is one of those kinds, which are the most easy of cure, as is confirmed by observers, especially Duverney. Formerly frequent injections, either with simple olive oil, or oil of almonds, were recommended. The injection was retained by a piece of cotton, and when there was reason to believe that the matter was sufficiently softened, an attempt was made to extract it by means of a small scoop-like instrument. Various experiments were made by Haygarth, at Chester, in 1769, from which it appears that warm water is preferable to oil. The water dissolves the mucous matter, which connects together the truly ceruminous particles, and which is the cause of their tenacity; other applications only succeeding by reason of the water which they contain.

The lodgment of hard pellets of wax, if neglected, may ultimately produce ulceration of the tympanum, and other serious mischief. Thus, in one case, Ribes and Chaussier found the handle of the malleus separated from its head, partly destroyed, and covered with the hardened cerumen that

had made its way into the tympanum. (See *Dict. des Sciences Med.* T. 38, p. 30.)

"The symptoms (says Mr. Saunders) which are attached to the inspissation of the cerumen are pretty well known. The patient, besides his inability to hear, complains of noises, particularly a clash or confused sound in mastication, and of heavy sounds, like the ponderous strokes of a hammer.

"The practitioner is led by the relation of such symptoms to suspect the existence of wax; but he may reduce it to a certainty by examination.

"Any means capable of removing the inspissated wax may be adopted; but syringing the meatus with warm water is the most speedy and effectual, and the only means necessary. As the organ is sound, the patient is instantaneously restored." (*Anatomy of the human Ear, with a Treatise on its Diseases, by J. C. Saunders, 1806, p. 27, 28.*)

In order to throw an injection into the ear with effect, a large syringe, capable of holding, at least, six or eight ounces, should be employed; and the fluid should be injected with a good deal of force, care being taken to let it enter in the natural direction, and not against one of the sides of the passage. The surgeon must also avoid pressing the pipe too deeply into the ear, so as to hurt the tympanum. As the fluid regurgitates with considerable rapidity, a small basin is to be held close up to the ear at the time of using the syringe, so as to catch the water, and hinder it from wetting the patient's clothes; for the surer prevention of which a napkin is also to be laid over the shoulder. In general it is necessary to throw the water into the ear six or seven times, or more, ere the pellets of wax are loosened, and entirely brought out; and, sometimes, the injections will not completely succeed the first day on which they are employed. The evening before the syringe is to be used, it may occasionally be best to drop a little sweet oil into the ear.

7. Discharges from the Meatus Auditorius.

Purulent discharges from the ear either come from the meatus auditorius externus itself, or they originate from suppuration in the tympanum, in consequence of blows on the head, abscesses after malignant fevers, the small-pox, or the venereal disease. In such cases, the little bones of the ear are sometimes detached, and escape externally, and complete deafness is most frequently the consequence. However, in a few instances, total deafness does not always follow even this kind of mischief, as I myself have witnessed on one or two occasions. There is greater hope when the disorder is confined to the meatus; as judicious treatment may now avert the most serious consequences. In Acrel's surgical cases, there is a case relative to the circumstance of which we are speaking. Suppuration took place in the meatus auditorius externus, in

consequence of acute rheumatism, which was followed by vertigo, restlessness, and a violent headach. The matter discharged was yellowish, of an aqueous consistence, and acid smell. The meatus auditorius was filled with a spongy flesh. On introducing a probe, our author felt a piece of loose rough bone, which he immediately took hold of with a pair of forceps, and extracted. From the time when this was accomplished, the discharge diminished; and, with the aid of proper treatment, the patient became perfectly well.

The meatus auditorius, like all other parts of the body, is subject to inflammation. This is frequently produced by exposure to cold. It is hardly necessary to say, that generally topical bleeding and antiphlogistic means are indicated. The meatus auditorius should also be protected from the cold air, particularly in the winter season, by means of a piece of cotton.

Mr. Saunders observes, "When the means employed to reduce the inflammation have not succeeded, and matter has formed, it is generally evacuated, as far as I have observed, between the auricle and mastoid process, or into the meatus. If it has been evacuated into the meatus, the opening is most commonly small, and the spongy granulations, squeezed through a small aperture, assume the appearance of a polypus. Sometimes the small aperture, by which the matter is evacuated, is in this manner even closed, and the patient suffers the inconvenience of frequent returns of pain from the retention of the discharge. When the parts have fallen into this state, it will be expedient to hasten the cure by making an incision into the sinus, between the auricle and mastoid process.

"It occasionally happens, that the bone itself dies, in consequence of the sinus being neglected, or the original extent of the suppuration. The exfoliating parts are the meatus externus of the os temporis or the external lamina of the mastoid process. (P. 24, 25.)

8. Excrescences in the Meatus Auditorius.

Though the membrane, lining the meatus auditorius, is very delicate, it is not the less liable to become thickened, and to form polypous excrescences. This case, however, is not common. As such tumours are ordinarily firmer in their texture than polypi of the nose, they are sometimes not so easily extracted with forceps. When they are situated near the external orifice, and admit of being taken hold of with a small pair of forceps, or a hook, they may easily be cut away, when drawn outward, and this without any reason for fearing hemorrhage. This, indeed, is usually very trivial. When the tumours are more deeply situated, Mr. B. Bell recommends the use of a ligature. Here the same plan may be pursued as will be explained in the article *Polypus*. But, it sometimes happens, that the excrescences cannot be removed in this manner; as instead of being adherent by a narrow

neck, they have a broad base, which occupies a considerable extent of the passage. In such cases, the use of escharotics has been absurdly proposed; but, as these applications cannot be used without risk of injuring the membrane of the tympanum, it is better to have recourse to another method. (*Encyclopédie Méthodique; Partie Chirurgicale, Art. Auditif conduit.*) Mr. B. Bell recommends dilating the passage with bougies; but it is obvious that the pressure of such instruments would also be very likely to irritate and inflame the membrane of the tympanum.

9. *Herpes of the Meatus Auditorius.*

An herpetic ulcerous eruption sometimes affects the meatus auditorius and auricle, producing considerable thickening of the skin, and so great an obstruction of the passage, that a good deal of deafness is the consequence. Mr. Saunders remarks, that, in this case, "the ichor, which exudes from the pores of the ulcerated surface, inspissates in the meatus, and not only obstructs the entrance of sound, but is accompanied with a great degree of fœtor. This disease is not unfrequent. I have never seen it resist the effect of alterative medicines," the use of injections containing the oxy muriate of quicksilver, and the application of the unguentum hydrargyri nitrati. Mr. Saunders exhibited calomel as the alterative, and, in one instance, employed a solution of the argentum nitratum, as an injection. (Page 25, 26.) When the disease is obstinate, a seton should be made on the nape of the neck, or a blister be applied behind the ear.

10. *Affections of the Tympanum.*

The ear is sometimes affected with a puriform ichorous discharge, attended with a loss of hearing, proportionate to the degree of disorganization which the tympanum has sustained. Frequently, on blowing the nose, air is expelled at the meatus auditorius externus; and, when this is the case, it is evident, that the discharge is connected with an injury, or destruction of the membrana tympani. However, when the Eustachian tube is obstructed with mucus, or matter, or when it is rendered impervious, and permanently closed by inflammation, the membrana tympani may not be perfect, and yet, it is clear, no air can in this state be forced out of the external ear in the above manner. An examination with a blunt probe, or with the eye, while the rays of the sun fall into the passage, should therefore not be omitted. If the membrane have any aperture in it, the probe will pass into the cavity of the tympanum, and the surgeon feel that his instrument is in contact with the ossicula.

In this manner, the affection may be discriminated from an herpetic ulceration of the meatus auditorius externus. The causes are various: In scarlatina maligna, the membrana tympani occasionally inflames, and sloughs; all the ossicula are discharged, and, if the patient live, he often continues

quite deaf. An earach, in other words, acute inflammation of the tympanum is the most common occasion of suppuration in this cavity, in which, and the cells of the mastoid process, a good deal of pus collects. At length the membrana tympani ulcerates, and a large quantity of matter is discharged; but, as the secretion of pus still goes on, the discharge continues to ooze out of the external ear.

Instead of stimulating applications, inflammation of the tympanum demands the rigorous employment of antiphlogistic means. Unfortunately, it is a too common practice, in this case, to have recourse to acrid spirituous remedies. Above all things, the repeated application of leeches to the skin behind the external ear, and over the mastoid process, should never be neglected. As soon as the inflammation ceases, the degree of deafness occasioned by it, will also disappear. This, however, does not always happen.

When an abscess is situated in the cavity of the tympanum, Mr. Saunders thinks, that the membrana tympani should not be allowed to burst by ulceration, but be opened by a small puncture. (P. 31.) However, unless there were the strongest ground for believing, that the Eustachian tube were impervious, this advice, I think, ought not to be followed, more especially as the symptoms are generally too vague to afford any degree of certainty in the diagnosis.

Sometimes the disease, of which we are treating, is more insidious in its attack: slight paroxysms of pain occur, and are relieved by slight discharges. The case goes on in this way, until, at last, a continual discharge of matter from the ear takes place. The disorder is destructive in its tendency to the faculty of hearing, and it rarely stops until it has so much disorganized the tympanum and its contents, as to occasion total deafness. Hence, Mr. Saunders insists upon the propriety of making attempts to arrest its progress,—attempts which are free from danger; and he censures the foolish fear of interfering with the complaint, founded on the apprehension, that bad constitutional effects may originate from stopping the discharge.

If the case be neglected, the tympanum is very likely to become carious; before which change, the disease, says Mr. Saunders, is mostly curable.

Mr. Saunders divides the complaint into three stages: 1. A simple puriform discharge. 2. A puriform discharge complicated with fungi and polypi. 3. A puriform discharge with caries of the tympanum. As the disease is local, direct applications to the parts affected are chiefly entitled to confidence. Blisters and setons may also be advantageously employed. Mr. Saunders's practice consisted in administering laxative medicines and fomenting the ear, while inflammatory symptoms lasted, and afterward injecting a solution of the sulphate of zinc, or cerussa acetata.

In the second stage, when there were

fungi, he removed or destroyed them with forceps, afterward touched their roots with the *argentum nitratum*, or injected a solution of alum, sulphate of zinc, or *argentum nitratum*.

Writers describe a relaxed state of the *membrana tympani*, as a cause of deafness. If, says a late author, after a discharge from the *meatus auditorius externus*, or cavity of the tympanum, or a dropsy of the latter cavity, the hearing remains hard, there is reason to suspect, that the infirmity may depend upon relaxation of the membrane of the tympanum, or paralysis of the internal muscle of the malleus. This suspicion will be strengthened, if the deafness should increase in damp, and lessen in dry weather; and particularly, if it be found, that the hearing is benefited by introducing into the ear dry warm tonic applications, such as the smoke of burning juniper-berries, or other astringent vegetable substances. The decoction of bark, used as an injection, is also said to have done good.

The relaxation of the tympanum, alleged to proceed from a rupture of the muscle of the malleus, is deemed incurable; but it is not so with the case, which depends upon paralysis of this muscle. Here tonic injections into the tympanum, through the Eustachian tube, are recommended. (*Dict. des Sciences Med.* T. 38, p. 50.) Electricity, stimulating liniments and gargles, and a blister, might also be tried.

Imperfect hearing is supposed sometimes to arise from preternatural tension of the membrane of the tympanum, indicated by the patient hearing better in wet than dry weather, and by his hearing what is spoken in a low tone, near his ear, better than any thing said in a loud manner. The opinions, delivered by writers on the causes of this affection, are only uncertain conjectures. The local treatment recommended, consists of injecting into the *meatus auditorius*, emollient decoctions, or warm milk, or introducing into the passage a dossil of soft cotton, dipped in oil of sweet almonds. Nothing certain is known respecting the proper constitutional treatment, as must be clear from our ignorance of the causes of this form of disease of the ear.

Hardness of hearing appears sometimes to be caused by a chronic thickening of the membrane of the tympanum; and it is alleged, that there are cases of this description, which proceed from syphilis, and require mercury. An issue in the arm nearest the affected ear, and emollient and slightly stimulant injections, are likewise commended. When the tympanum was so considerably thickened, that there was no chance of restoring it to a healthy state, Portal questioned whether it might not be advisable to make a small opening in it? (*Précis de Chir. Pratique*, T. 2, p. 480.) This operation, which is said to have been first suggested by Cheselden, will be considered in the ensuing section.

Morgagni found the cavity of the tympanum intersected by numerous membranes,

which impeded the movements of the ossicula. (*Epist. an.* 6, § 4.)

Meckel does not mention any example of a deficiency of all the ossicula. (*Handb. des Pathol. Anat.* B. 1, p. 402.) Mersanni, however, found the incus wanting. (*Bonet Sepulch.* T. 1, sect. 19, Obs. 4, § 1.) Caldani, the malleus and incus. (*Epist. ad Haller*, T. 6, p. 142.) The latter case was unattended with any bad effect on the hearing; the first with deafness. In a deaf child, three years of age, Bailly found the ossicula of only 1-3 their proper size. (*Bonet Sepulch.* T. 1, sect. 19, Obs. 4, § 3.) In an example, where the fenestra rotunda was obstructed, Cotunni found the ossicula twice as large as natural. (*De labyrinthi auris contentis*, § 72, and *Meckel's Handb. des Pathol. Anat.* B. 1, p. 402.) A case, in which all the ossicula were wanting, is now on record. (See *Dict. des Sciences Med.* T. 38, p. 114.)

11. Obstruction of the Eustachian Tube.

This is often a cause of a considerable degree of deafness, because it is necessary for perfect hearing, that air should be conveyed from the mouth through this passage into the cavity of the tympanum, which now can no longer happen.

A degree of deafness generally attends a severe cold, which is accounted for by the Eustachian tube being obstructed with thickened mucus. Mr. Saunders tells us, that the obstruction most frequently arises from syphilitic ulcers in the throat, or sloughing in the *cynanche maligna*. The deafness comes on when such sores are healed, that is, when the obstruction is complete. The descent of a nasal polypus into the pharynx, and enlarged tonsils, have also been known to close the tube. (P. 42.)

When the Eustachian tube is obstructed, the patient cannot feel the *membrana tympani* crackle, as it were, in his ear, on blowing forcibly with his nose and mouth stopped. Previous ulceration, or disease, of the throat will sometimes facilitate the diagnosis.

When the Eustachian tube is obstructed with mucus, it has been proposed to employ injections, which are to be thrown by means of a syringe and catheter, into the guttural orifice of that canal. This operation, however, is alleged to be always attended with trouble, and, when the *os spongiosum inferius* happens to be situated near the floor of the orbit, the introduction of any instrument, like a female catheter, would be impracticable. (*Richerand Nosogr. Chir.* T. 2, p. 131, edit. 2.)

Mr. A. Cooper had noticed, that hearing was only impaired, not lost, when suppurations in the tympanum had injured, and even destroyed the *membrana tympani*, and that the degree of deafness by no means equalled what resulted from an obstruction of the Eustachian tube. Hence, when the tube was permanently obliterated, he conceived, that a small puncture of the *membrana tympani* might be the means of enabling the patient to hear. This gentleman reports four cases,

in which the experiment was made with success.

The operation consists in introducing an instrument, resembling a hydrocele trocar, but curved, into the meatus auditorius externus, and pushing it through the anterior and inferior part of the membrana tympani; a place rendered most eligible, on account of the situation of the chorda tympani and manubrium of the malleus, parts which should be left uninjured. The instrument must not be introduced far, lest it wound the vascular lining of the tympanum, and cause a temporary continuance of the deafness by an effusion of blood. When the puncture is made, in proper cases, and in a judicious manner, hearing is immediately restored. A small hole in the membrana tympani now conveys the air into the cavity of the tympanum, answering the same purpose as the Eustachian tube.

The surgeon will be able to operate with more ease, if he take care to lessen the curvature of the meatus auditorius by drawing upward the external ear.

There is some chance of a relapse in consequence of the opening closing up. This consideration led Richerand to propose making the aperture with caustic, so as to destroy a part of the membrane. (*Nosogr. Chir. T. 2, p. 132, edit. 2.*) The suggestion is not likely to be adopted, on account of the inconveniences of applying caustic within the ear. Mr. Saunders is an advocate for making the opening large. This gentleman instantaneously restored the hearing of one patient who had been deaf thirty years, in consequence of a destruction of a part of his palate by syphilis. (*P. 45.*) In an instance where a young man had been deaf for eight years, apparently from obstruction of the Eustachian tube by swellings and disease about the throat. Paroisse also restored the hearing directly, by perforating the anterior and inferior part of the tympanum. (*Opuscules de Chir. p. 309, 8vo. Paris, 1806.*) The practice has also been successfully adopted by Michaelis in one case, and Hunold has tried it in a vast number of examples, two-thirds of which succeeded. (*Dict. des Sciences Med. T. 38, p. 63.* Mr A. Cooper's cases are in the *Phil. Trans. for 1802.*)

Puncturing the membrana tympani has been attended with some degree of success in France, where it has been tried by Itard, Celliez, and Maunoir, &c. It is not to be dissembled, however, that it is liable to failure. Dubois performed the operation in four instances, without success. (*Richerand Nosogr. Chir. T. 2, p. 132.*)

In most cases, the patients benefited are said to have experienced pain just after the trochar was withdrawn. The organ, not being accustomed to sound, had become so extremely sensible, that it could bear the gentlest impression of the sonorous vibrations, and the patient's first request after the perforation had been made, was, that persons near him might speak softly. This

excessive tenderness of the sense gradually subsides.

The two principal objections made to the foregoing practice, are the risk of injuring that part of the tympanum, which is connected with the malleus, and the tendency of the puncture to heal up again. (See *Dict. des Sciences Med. T. 38, p. 57*; *Maunoir in Journ. de Med. T. 13*; *Sabatier, Traité d'Anatomie, T. 2, p. 186.*) The author of the article *Oreille* in the latter dictionary, who cannot, however, be deemed at all partial to the operation, delivers the following judgment concerning it:—1. It is the only operation, which is likely to answer, where the tympanum is cartilaginous or ossified, and the rest of the organ is sound. 2. It will be attended with some success, where the Eustachian tube is closed, and this defect cannot be otherwise removed. 3. It will be useless where the cavity of the tympanum is filled with matter, which is too thick to escape through the puncture. 4. When deafness depends on paralysis of the auditory nerve. 5. When the infirmity arises from inflammation of the ear or nervous irritation. 6. From fevers, the Eustachian tube being pervious.

The limits of this work will not allow me to introduce the directions given by various authors for injecting fluids into the Eustachian tube: Wathen, Baron Boyer, and the latest surgeons, who have considered this operation, seem to agree, that it is more easily performed by passing the tube through one of the nostrils, than the mouth. Wathen's instruments are described in *Phil. Trans. 1794*; those of Baron Boyer in *Traité des Mal. Chir. T. 6, p. 391*; and those of another modern advocate for this operation, in *Dict. des Sciences Med. T. 38, p. 108.* The latter author, after stating how his tubes, which are four French inches in length, and shaped somewhat like an italic S, are introduced, enumerates the following as the advantages derived from their employment. 1. Fluid applications may be conveyed into the Eustachian tube, the cavity of the tympanum, and the mastoid cells, and deeply seated obstinate ulcerations within these parts cured. 2. The same parts can be cleared from any mucus with which they are obstructed. 3. Blood extravasated within the tympanum, from blows on the head, can be washed out. 4. Chalky substances, which sometimes form in the tympanum, may be brought out in the same manner. 5. Through the tube a stilet can be passed into the Eustachian tube, so as to perforate a congenital septum, or any cicatrix, obstructing the entrance of that passage. 6. When the sensibility of the auditory nerve is dull, the effect of fluids thrown into the tympanum, can be tried.

12. Of perforating the Mastoid Process.

Of all the cases of deafness, for which Arneman and others have recommended this operation, that attended with an abscess and caries of this process is the only one, in which the practice is now at all sanctioned.

An instance is related by Jasser, in which the carious surface of the right mastoid process was exposed by an incision, and an opening detected with a probe. An injection was thrown into the aperture with a syringe, when, to the astonishment of Jasser and his patient, the fluid gushed out of the right nostril. The plan was repeated for a few days, and, at the end of three weeks, the part was healed, and the hearing greatly improved. This success induced Jasser to make a perforation in the left mastoid process, the ear on that side being deaf, and to employ the injection, which was also discharged from the left nostril. The hearing, however, was not so completely restored in this as it had been in the right ear; but the wound healed up, without any extolations. (*Journ. de Med. Fev. 1793.*) The idea of perforating the mastoid process was suggested long before the time of Jasser. Riolan, in various parts of his works, suggests the propriety of making a small perforation in several cases of deafness, and tinnitus aurium, attended with obstruction of the Eustachian tube. Rolfincius also advised a similar opening to be made in the mastoid process with a trocar, in cases of dropsy of the cavity of the tympanum and of the mastoid cells. Jasser, however, was the first who actually made the experiment, and his example was followed by Hagstroem, whose attempt did not succeed, the completion of the operation having been interrupted by profuse hemorrhage, and no benefit done to the hearing. The injections also appear to have caused, in this instance, alarming symptoms, violent pain in the head, loss of vision, sense of suffocation, and syncope. The fluid entered the mastoid cells, without any of its issuing, either by the nostrils or mouth. (*Op. cit.*)

The operation was successfully tried by Löffler. The injection did not pass into the mouth, yet the hearing was restored, though it was lost again when the wound closed. Hence, a new opening was made, and kept from healing by means of a piece of cat-gut. The patient was afterward able to hear when his mouth was open.

The perforation of the mastoid process was not approved of by Morgagni; indeed, it must often fail, as both Morgagni and Hagstroem have observed, on account of complete bony partitions preventing all communications between the mastoid cells; and sometimes the mastoid process, instead of being cellular, is perfectly solid, an instance of which is recorded by A. Murray.

13. Diseases of the Labyrinth.

These are much more diversified than might, at first, be supposed, and, if we admit the two doubtful cases, said to depend upon the state of the lymph of Cotunni, there are not less than seven different species of disease affecting the labyrinth:—1. Disease of the fenestra ovalis, and fenestra rotunda, as ulceration, thickening, &c. 2. Malformation of these apertures. 3. Malformation of the labyrinth. 4. Inflamma-

tion of the nervous membrane, which lines its cavities. 5. Alteration of the liquor of Cotunni. 6. Deficiency of the same fluid. 7. Affections of the nerve of hearing.

No doubt deafness (and that kind of it which so frequently foils the most skillful men) often arises from an insensible state of the portio mollis of the auditory nerve, or of the surfaces, on which its filaments are spread. This affection is analogous to the amaurosis, or gutta serena, in which, though every part of the eye may seem to possess its natural structure, sight is lost, because the rays of light only strike against a paralytic, or insensible retina. Mr. Saunders dissected the ears of two deaf patients, with the greatest care, but could not discover the least deviation from the natural structure. In the commencement of deafness from a paralytic affection of the auditory nerve, Mr. A. Cooper remarked, that the secretion of cerumen was diminished, and, when the deafness became worse, was totally suppressed. And another particular symptom of paralysis of the auditory nerve, pointed out by the same author, is the patient's inability to hear the sound of a watch placed between the incisor teeth.

With respect to the causes of a paralytic affection of the auditory nerve, they are mostly buried in great obscurity, and some of them probably depend upon congenital imperfection of the nerve, or brain itself. It seems, however, that a part of the causes, to which we allude, act mechanically, as an extravasation of blood, a steatoma, or an exostosis; while others operate upon the ear by sympathy, as is the case when deafness is produced by the presence of worms in the bowels.

Mr. Saunders remarks, that all the diseases of the internal ear may be denominated nervous deafness; the term, in this sense, embracing every disease, the seat of which is in the nerve, or parts containing the nerve. Nervous deafness is attended with various complaints in different cases, noises in the head of sundry kinds, the murmuring of water, the hissing of a boiling kettle, rustling of leaves, blowing of wind, &c. Other patients speak of a beating noise, corresponding with the pulse, and increased by bodily exertion, in the same degree as the action of the heart. (*Saunders, p. 47.*)

According to this author, there is a syphilitic species of nervous deafness, attended with a sensation of some of the above peculiar noises: and one case is related, in which the hearing was completely restored, in five weeks, by a mercurial course.

Mr. Saunders relieved several cases of nervous deafness by confining patients to low diet, giving them calomel freely, repeated doses of sulphate of soda, magnesia, sometimes twice, sometimes thrice, a week, or according to circumstances, and applying blisters behind the ears at intervals of a week. The plan requires perseverance.

Electricity has been highly recommended for the cure of nervous deafness, though the prospect of benefit from it must entirely

depend upon the nature of the cause of the infirmity. It is allowed to be sometimes useful in cases of incomplete paralysis of the auditory nerve; but, it cannot be of any service where the Eustachian tube, the cavity of the tympanum, or the mastoid cells, are obstructed. It is set down as hurtful, when the patients are very irritable, and subject to vertigo, bleeding from the nose, great determination of blood to the head, &c. (*Dict. des Sciences Med.* T. 38, p. 124.) The evidence, in favour of the efficacy of galvanism, is still more scanty and questionable.

Whether in certain cases of deafness from torpor of the auditory nerve, the introduction of tonic injections into the cavity of the tympanum, through the Eustachian tube, will answer in the manner stated by a late writer, future experience must determine. (*Dict. des Sciences Med.* T. 38, p. 120—121.)

This article, I think, may be usefully concluded with a few general, but sensible observations on the various kinds of deafness, made by a modern writer. According to Professor Rosenthal, all the disorders of the sense of hearing may be comprised under three principal forms.

1. Deafness (*Surditas*, *Cophosis*) in which the faculty of hearing articulated sounds is completely annihilated.

2. Hardness of hearing (*Dysæcia*) in which this faculty is so diminished, that articulated sounds cannot be heard, without the assistance of a particular apparatus.

3. Alteration, or diminution of hearing (*Paracusis*) in which the faculty of hearing articulated sounds, in the natural way, is imperfect for want of precision.

1. Deafness, Rosenthal distinguishes into two degrees, the first of which is marked by an absolute impossibility of hearing at all; the second, by a power of still distinguishing certain sounds, as whistling, the vowels, &c. The first is usually congenital, and a cause of dumbness.

The discrimination of these two degrees, Rosenthal considers of great importance in practice, and especially in institutions for the deaf and dumb; because the exceedingly fine sense of touch, with which deaf persons are sometimes gifted, is apt to be mistaken for the faculty of hearing. This fact is illustrated by some interesting experiments made by Pfingsten on deaf and dumb persons. (*Vieljaehrige Erfahrung ueber die Gehoerfehler der Taubstummen*, Kiel. 1802, p. 32.) A deaf and dumb girl, who was at needlework in a room near the house-door, regularly gave notice whenever it was opened or shut. As the door was furnished with a little bell, which rung loud enough whenever the door moved to be plainly heard in the neighbouring room, and, with the exception of this noise, no other impulse nor shock could be distinguished, Pfingsten was surprised at the circumstance. Desirous of ascertaining how the girl really knew about the movements of the door, he caused the bell to be rung

with great force without the door being opened: the child was perfectly unconscious of the noise. The bell was afterward kept still, while a person opened and shut the door so softly, that Pfingsten himself could not hear it; yet, the child instantly gave warning, that somebody had entered. The inference was, that the chair, on which she sat, communicated to her legs and back a certain impulse, which made her conscious of the motion of the door.

The dissection of the ears of deaf and dumb persons has evinced some facts, explanatory of the cause of the loss of hearing. Among other things, it appears, that complete deafness, whether congenital, or acquired, more frequently depends upon morbid alterations of the soft parts, than upon any irregularity in the formation of the bones. Thus, in the body of a person, who had been deaf and dumb while living, Hoffmann found the auditory nerve diminished in size, while every other part of the organ was perfectly natural. Arneemann found the nerve harder than common. Dr. Haighten met with an instance, in which the vestibulum was filled with a caseous substance. (*A case of original deafness*, in *Mem. of the Med. Society*, Vol. 3, p. 1—15.) Duverney and Sandifort found the auditory nerve strongly compressed by a steatoma. In one case, Itard found every part of the ear apparently so natural, that the deafness could not be ascribed to paralysis of the nerve. In another, the infirmity depended upon obstruction of the passages. In a third, the cavity of the tympanum, and the vestibulum, contained small portions of calcareous matter. He has also seen the tympanum filled with a thick yellow lymph, or a thin fluid enclosed in membranous cells. In the dissection of the body of a deaf and dumb person, Rosenthal noticed, among other remarkable circumstances, a greater hardness of the auditory, than of the facial nerve, and preternatural firmness of the medulla oblongata. Thickening of the membrane of the tympanum. The bony roof of the cavity of the tympanum not thicker than paper, and just over the junction of the malleus with the incus, the bony substance was so absorbed, that an appearance like that of membrane alone remained. The mastoid cells, cavity of the tympanum, and the Eustachian tubes contained a limpid yellow fluid. In the tympanum, the periosteum was thickened, forming small cells around the ossicula, which were of their natural structure. Nothing particular was remarked in the labyrinth.

In a small proportion of instances, the above degree of deafness has been traced to anomaly in the structure of the solid parts. Thus, Mundini found the cochlea composed of only one circle and a half. (*Opusc. Acad. Bonon.* 1791, T. 7, p. 422.) Valsalva found the stapes adherent to the fenestra ovalis. (*De Aure Humanâ*, cap. 11;) and Reimarns the ossicula entirely wanting. (*Kunstrieb der Thiere*, p. 57.)

In the first degree of deafness above described, which when congenital, must excite

suspicion of serious malformation of the organ, and abolition of the nervous influence, and when acquired indicates a complete injury of the functions of the nerve, the prognosis, as Rosenthal observes, must be unfavourable. Nor can it be otherwise in the second congenital degree of the disease, though only a partial imperfection of the organ and nerve can here be supposed. On the other hand, when the latter degree is *acquired*, there is more prospect of relief, because merely a partial alteration in the soft parts is to be suspected.

2. *Hardness of hearing.* Rosenthal also distinguishes several degrees of, what is termed, hardness of hearing. In the first, the patient cannot hear a distant noise, and especially high tones; but, he can perceive, though it is true not in a very distinct manner, articulated sounds, when the voice is a good deal raised. In the second degree, he hears and distinguishes both high and low tones very well, and also words, but only when the voice is somewhat raised.

These two cases are better understood, inasmuch as it is tolerably well ascertained, that the immediate cause of the infirmity is some alteration in that part of the organ, which serves as a conductor for the vibrations of sound, or else an increased sensibility of the nerve, all the internal ear being in other respects right.

Among alterations of the conducting parts of the organ, Rosenthal comprehends:

1. A total obliteration of the meatus auditorius externus, its imperforation, or complete absence. These cases may almost always be detected by a superficial examination, the patient only hearing when some solid bodies are placed between his teeth, while his dull perception of sounds does not appear to be much lessened when the ear is covered.

2. Diseases of the cavity of the tympanum, as inflammation of its membranous lining, caries of its parietes, or collections of blood, pus, or other fluid, in its cavity. Rosenthal thinks there can be no doubt, that inflammation and suppuration in the tympanum are much more frequent than is generally supposed, the former affection being often mistaken for a slight attack of rheumatism. In dissecting aged subjects, he has frequently found the membrane of the tympanum thickened and opaque, and he could only impute this appearance to previous inflammation.

After detailing a case, illustrative of the symptoms of inflammation within the tympanum, and a few observations on caries, and collections of fluid in that cavity, Rosenthal notices the *hardness of hearing, connected with nervous irritability*, in the treatment of which case, he insists upon the advantage that would result from a knowledge of the particular species of morbid excitement prevailing in the patient. But, as nothing very certain can be made out on this point, and only conjectures can follow some dissections of bodies, that the affection consists either in a determination of blood

to the part, or in a partial paralysis of the auditory nerve, the exact nature and form of which are quite incomprehensible, it is absolutely necessary to attend solely to the diagnosis of the nervous affection in general. This diagnosis will be facilitated; 1st. If the patient has been previously very sensible to the impression of certain tones, or sound in general. 2dly. If the power of hearing has been lost all on a sudden, without any mark of inflammation. 3dly. If the affection coincides with other nervous disorders.

3. *Alteration, or Diminution of Hearing.* Between the most perfect hearing, congenital or acquired, and this point of diminution of the faculty of hearing, Rosenthal observes, there are a great many degrees, the cause of which is the more difficult to comprehend, as the circumstances of structure, which enable every part to perform its functions with freedom and perfection, are not yet made out. If, says he, it were in our power to determine what is truly the regular structure of each part, we should then be furnished with a means of judging correctly of the anomalies of function, the changes in which would be indicated quite as clearly as in the eye, by shades of organization, absolutely in the same way, as we judge of the modifications, which the image of objects must undergo at the bottom of the ocular mirror, by the greater or less convexity of the cornea, or lens, or the consistence of the other humours.

In the present state of physiological and pathological knowledge of the ear, therefore, Rosenthal conceives, that little can be attempted with respect to a scientific classification of these cases of altered, or diminished hearing. As the cavity of the tympanum and its contents are the parts, which have principal influence over the intensity of sound, and a great share in the propagation of articulated sounds, their faulty condition must here be chiefly the subject for consideration. And, among their numerous defects, traced by dissection, and already specified in the foregoing columns, Rosenthal particularly calls the attention of the reader,

1. To alterations of the membrane of the tympanum, whether proceeding from congenital malformation, or situation, or from thickening, ossification, perforation, or laceration of the same part.

2. The lodgment of some fluid in the cavity of the tympanum, more frequently produced, than is commonly supposed, by obstruction of the Eustachian tube. In most new-born infants, Rosenthal has also found the cavity of the tympanum filled with a thick, almost gelatinous fluid, which for some days is not absorbed, and is probably the cause of the indifference, evinced by new-born children, to sounds, which are even so intense as to be offensive to the ears of an adult.

3. Alterations of the membrane of the fenestra rotunda, such as its imperfect formation, or erroneous situation, its thickened state, &c.

But, it is remarked by Rosenthal, that as the difference in the intensity of sound may occasion a modification in the sensations of the ear, the merely conducting parts of the auditory apparatus must not be forgotten, as the external ear and the meatus auditorius externus, which regulate the quantity of sonorous waves, which strike the auditory nerve. However, the malformations of the meatus, and the state of the ceruminous secretion within it, are observed by Kriiter and Lentin (*Ueber das Schwere Gehoere*, L. 19, Leipz. 1794.) to have more effect on the hearing, than defects of the auricle itself, the whole of which, as we have stated, may be lost without any material deafness being produced. Lastly, Rosenthal calls our attention to the nervous action, or influence, which, whether too much raised, or depressed, may equally render the hearing dull; and some useful information may for the most part be derived from attending to the patient's general sensibility. (See *Journ. Complem. T. 6, p. 21, &c.* Duverney de l'Organe de l'Ouïe, 12mo. 1633; P. Kennedy, *A Treatise on the Eye, and on some of the Diseases of the Ear*, 8vo. Lond. 1713. A. D. Dienert, *Quæstio, &c. an absque Membrana Tympani apertura topica injici in concham possint*, Paris 1748. *Mémoire sur la Théorie des Maladies de l'Oreille, et sur les moyens que la Chirurgie peut employer pour leur curation, in prix de l'Acad. de Chir. T. 9, p. 111, &c.* Edit. 12mo. I. D. Arnemann, *Bemerkungen über die Durchbohrung des Processus Mastoideus in gewissen Fällen der Taubheit*, 8vo. Gott. 1792. G. R. Trampel *von den Krankheiten des Ohres in Arnemann's Magazin für die Wundarzneiwissenschaft*, B. 2, p. 17, &c. 8vo. Gott. 1798. Richerand, *Nosogr. Chir. T. 2, p. 135, &c.* Edit. 4. A. Cooper, in the *Phil. Trans. for 1802*; *Saunders on the Anatomy and Diseases of the Ear*, 1806. Desmonceaux, *Traité des Maladies des Yeux et des Oreilles*, 2. Tom. 8vo. Paris, 1806 Lassus, *Pathologie Chirurgicale*, T. 1, p. 84, Edit. 1809. W. Wright, *An Essay on the Human Ear, its Anatomical Structure, and incidental Complaints*, 8vo. Lond. 1817. *Dict. des Sciences Med. art. Oreille*, T. 38, 8vo. Paris, 1819. Rosenthal, *Essai d'une Pathologie de l'Organe de l'Ouïe*, in *Journ. Complémentaire du Dict. des Sciences Méd. T. 6, p. 17, 8vo.* Paris, 1820. *For an account of malformations of the organ, see Meckel's Handbuch der Pathol. Anat. B. 1, p. 400, &c.* 8vo. Leipz. 1812.)

ECCHYMOSIS. (from *exquo*, to pour out) A superficial, soft swelling, attended with a livid or blue colour of the skin, produced by blood extravasated in the cellular substance.

The causes of ecchymosis are falls, blows, sprains, &c. which occasion a rupture of the small vessels on the surface of the body, and a consequent effusion of blood, even without any external breach of continuity. Ecchymosis is one of the symptoms of a contusion. (See *Contusion*.) A considerable ecchymosis may originate from a very slight bruise, when the ruptured vessels are

capable of pouring out a large quantity of blood, and particularly when the parts contain an abundance of loose, cellular substance. In general, ecchymosis does not make its appearance immediately after the blow, or sprain, and sometimes not till several hours after the application of the violence: at least, it is not till this time that the black, blue, and livid colour of the skin is most conspicuous. A black-eye, which is only an ecchymosis, is always most disfigured six or eight hours after the receipt of the blow.

In the article *Bleeding*, we have noticed how an ecchymosis may arise from the blood getting out of the vein into the adjacent cellular substance.

Common cases of ecchymosis may generally be easily cured, by applying discutient lotions, and administering one or two doses of any mild purgative salt. The best topical applications are vinegar, the lotio muriatis ammoniæ; spirit. vin. camph. and the liquor ammon. acet.

The object is to avert inflammation, and to promote the absorption of the extravasated fluid.

In cases of ecchymosis, I have seen such success attend the practice of dispersing collections of extravasated blood, by means of absorption, that the plan of evacuating it by an incision, seems to me to be seldom necessary. When an opening is made, and air is admitted, the portion of blood, which cannot be pressed out, soon putrefies, and extensive inflammation and suppuration, are the too frequent consequences.

The quick and powerful action of the absorbent vessels in removing extravasations of blood, can now be no longer called in question, when we daily see it proved in modern practice, that the largest aneurismal swellings are thus speedily diminished and removed, after the operation of tying the arteries, from which such tumours arise.

I wish, however, the preceding observations merely to convey a general condemnation of the practice of opening swellings containing extravasated blood; for, no surgeon is more assured, than I am myself, that there are particular exceptions, in which the plan is highly proper and necessary. Thus, whenever a case of extensive ecchymosis, or a large tumour of extravasated blood, either excites suppuration, or creates excessive pain from distention, it is better to practise a free opening. So it sometimes happens, in cases of aneurism, that the skin breaks after the artery has been tied, and some of the blood escapes; but the remainder putrefies, and soon becomes blended with purulent matter in the sac. Here the making of a free incision for the discharge of the irritating contents of the swelling, with due attention to every caution, delivered in the article *Aneurism*, will often be followed by beneficial effects.

ECTROPIUM. (from *ectroon*, to divert.) A turning out, or an eversion of the eyelids.

It is remarked by Scarpa, that just as excessive relaxation of the skin of the eyelids,

and a morbid contraction of their lining, near the edges, in consequence of ulcerations and cicatrices, occasion a faulty inclination of the tarsus and eyelashes against the eye; so, sometimes, an elongation and swelling of the membranous lining of the eyelids, or too great a contraction and shortening of the skin of the eyelid itself, or neighbouring parts, produce an opposite disorder to *trichiasis*, viz. an eversion of the eyelids, termed *ectropium*.

Of course, in respect to causes, there are two species of this disease; one produced by an unnatural swelling of the lining of the eyelids, which not only pushes their edges from the eyeball, but also presses them so forcibly, that they become everted; the other, arising from a contraction of the skin covering the eyelid, or of that in the vicinity, by which means the edge of the eyelid is first removed for some distance from the eye, and afterward turned completely outward, together with the whole of the affected eyelid.

The morbid swelling of the lining of the eyelids, which causes the first species of *ectropium*, (putting out of present consideration a similar affection incidental to old age) arises mostly from a congenital laxity of this membrane, afterward increased by obstinate chronic ophthalmies, particularly of a scrofulous nature, in relaxed, unhealthy subjects; or else the disease originates from the small-pox affecting the eyes.

While the disease is confined to the lower eyelid, as it most commonly is, the lining of this part may be observed rising in the form of a semilunar fold, of a pale red colour, like the fungous granulations of wounds, and intervening between the eye and eyelid, which latter it in some measure everts. When the swelling is afterward occasioned by the lining of both eyelids, the disease assumes an annular shape, in the centre of which the eyeball seems sunk, while the circumference of the ring presses, and everts the edges of the two eyelids so as to cause both great uneasiness and deformity. In each of the above cases, on pressing the skin of the eyelids with the point of the finger, it becomes manifest that they are very capable of being elongated, and would readily yield, so as entirely to cover the eyeball, were they not prevented by the intervening swelling of their membranous lining.

Besides the very considerable deformity which the disease produces, it occasions a continual discharge of tears over the cheek, and, what is worse, a dryness of the eyeball, frequent exasperated attacks of chronic ophthalmia, incapacity to bear the light, and, lastly, opacity and ulceration of the cornea.

The second species of *ectropium*, or that arising from a contraction of the integuments of the eyelids, or neighbouring parts, is not unfrequently a consequence of puckered scars, produced by the confluent small-pox; deep burns; or the excision of cancerous, or encysted tumours, without saving a sufficient quantity of skin; or, lastly, the disorder is the effect of malignant carbun-

cles, or any kind of wound attended with much loss of substance. Each of these causes is quite enough to bring on such a contraction of the skin of the eyelids, as to draw these parts towards the arches of the orbits, so as to remove them from the eyeball, and turn their edges outward. No sooner has this circumstance happened, than it is often followed by another one equally unpleasant, namely, a swelling of the internal membrane of the affected eyelids, which afterward has a great share in completing the eversion. The lining of the eyelids, though trivially everted, being continually exposed to the air, and irritation of extraneous substances, soon swells, and rises up, like a fungus. One side of this fungus-like tumour covers a part of the eyeball; the other pushes the eyelid so considerably outward, that its edge is not unfrequently in contact with the margin of the orbit. The complaints induced by this second species of *ectropium*, are the same as those brought on by the first; it being noticed, however, that in both cases, whenever the disease is inveterate, the fungous swelling of the inside of the eyelids becomes hard, coriaceous, and, as it were, callous.

Although in both species of *ectropium*, the lining of the eyelids seems equally swollen, yet the surgeon can easily distinguish to which of the two species the disease belongs. For, in the first, the skin of the eyelids, and adjoining parts, is not deformed with scars, and by pressing the everted eyelid with the point of the finger, the part would with ease cover the eye, were it not for the intervening fungous swelling. But, in the second species of *ectropium*, besides the obvious cicatrix and contraction of the skin of the eyelids, or adjacent parts, when an effort is made to cover the eye with the everted eyelid, by pressing upon the latter part with the point of the finger, it does not give way so as completely to cover the globe, or only yields, as it ought to do, for a certain extent; or it does not move in the least from its unnatural position, by reason of the integuments of the eyelids having been so extensively destroyed, that their margin has become adherent to the arch of the orbit.

According to Scarpa, the cure of this disease cannot be accomplished with equal perfection in both its forms, the second species being, in some cases, absolutely incurable. For, as in the first species of *ectropium*, the disease only depends upon a morbid intumescence of the internal membrane of the eyelids, and the treatment merely consists in removing the redundant portion, art possesses many efficacious means of accomplishing what is desired. But, in the second species of *ectropium*, the chief cause of which arises from the loss of a portion of the skin of the eyelids, or adjacent parts, which loss no known artifice can restore, surgery is not capable of effecting a perfect cure of the malady. The treatment is confined to remedying, as much as possible, such complaints as result from this kind of eversion, and this can be done in a more or less satis-

factory manner, according as the loss of skin of the eyelid is little or great. Cases, in which so much skin is deficient that the edge of the eyelid is adherent to the margin of the orbit, Scarpa abandons as incurable. *Si nimum palpebræ deest*, says Celsus, *nulla id restituere curatio potest*: (*lib. 7. cap. 7.*) In the second species of ectropium, Scarpa thinks, that the degree of success attending the cure may always be estimated by remarking to what point the eyelid admits of being replaced, on being gently pushed with the end of the finger towards the globe of the eye, both before and after the employment of such means as are calculated to effect an elongation of the skin of the eyelid; for, it is to this point, and no further, that art can reduce the everted part, and permanently keep it so replaced.

When the first species of ectropium is recent, the fungous swelling of the lining of the eyelid not considerable, and, consequently, the edge of the eyelid not much turned out, and in young subjects (for in old ones the eyelids are so flaccid that the disease is irremediable.) Scarpa prefers destroying the fungous surface of the internal membrane of the eyelid by the repeated application of the *argentum nitratum*. In recent cases, where the patient is weak and irritable, (or a child) Beer commences the treatment with simply applying every day the tincture of opium, which, after a time, is to be strengthened by the addition of naphtha. To the relaxed conjunctiva he afterward applies escharotic eyesalves, and, last of all, the nitrate of silver, and muriate of antimony. Where the part is hard and callous, he precedes the employment of caustic by scarifications. (*Lehre, &c. B. 2, p. 136.*)

For remedying the considerable and inveterate form of the first species of the disease, the quickest and surest plan is to cut away the whole of the fungous swelling closely from the muscular substance, on the inside of the eyelid. This is the advice both of Beer and Scarpa. And, indeed, even in most cases which are not so slight, as to yield to mere astringent applications, this practice is now commonly preferred in this country to the use of caustic, the action of which is more tedious and painful, and less under control. The following is Scarpa's description of the operation.

The patient being seated, with his head a little inclined backward, the surgeon, with the index and middle finger of his left hand, is firmly to keep the eyelid everted, and holding a small pair of curved scissors, with convex edges, in his right, he is completely to cut off the whole fungosity of the internal membrane of the eyelid, as near as possible to its base. The same operation is then to be repeated on the other eyelid, should that be affected with the same disorder. If the excrescence should be of such a shape that it cannot be exactly included within the scissors, it must be raised as much as possible with forceps or a double-pointed hook, and dissected off at its base, by means of a small bistoury with a convex edge. This last

mode is preferred by Beer to the use of scissors, and I confess that it has always appeared to me the most convenient. The bleeding, which seems, at the beginning of the operation as if it would be copious, stops of itself, or as soon as the eye is bathed with cold water. The surgeon is then to apply the dressings, which are to consist of two small compresses, one put on the upper, the other on the lower arch of the orbit, and over these the uniting bandage, in the form of the monocolus, or so applied as to compress and replace the edges of the everted eyelids, in order to make them cover the eye. On the first removal of the dressings, which should take place about twenty-four or thirty hours after the operation, the surgeon will find the whole, or almost the whole, of the eyelid in its natural position. The treatment should afterward consist in washing the ulcer on the inside of the eyelid twice a day with simple water, or barley water, and *mel rosæ*, until it is completely well. If towards the end of the cure, the wound should assume a fungous appearance, or the edge of the eyelid seem to be too distant from the eyeball, the wound on the inside of the eyelid must be rubbed several times with the *argentum nitratum*, for the purpose of destroying a little more of the membranous lining, so that, when the cicatrization follows, a greater contraction of it may take place, and the edge of the eyelid be drawn still nearer the eye. Proper steps must be taken, however, for resisting the principal cause on which the ectropium depends, particularly chronic ophthalmia, a relaxed and varicose state of the conjunctiva, &c. (*See Ophthalmia.*)

In the second species of ectropium, or that produced by an accidental contraction of the skin of the eyelids, or neighbouring parts, the curative indication does in no respect differ from what it is in the foregoing instance. If a contraction of the integuments has proved capable of everting the eyelid, the excision of a piece of the internal membrane of the part, and the cicatrix which will follow, must also be capable, for the same reason, of bringing back the eyelid into its natural position. But, since nothing can restore the lost skin, the shortened state of the whole eyelid, in whatever degree it exists, must always continue, even after any operation the most skilfully executed. Hence, the treatment of the second species of ectropium will never succeed so perfectly as that of the first, and the replaced eyelid will always remain shorter than natural, in proportion to the quantity of integuments lost. It is true, that in many cases the eversion seems greater than it actually is, in regard to the small quantity of skin lost or destroyed: for, when the disease has once begun, though the contraction of the skin may be trivial, in consequence of the little quantity of it deficient, still the swelling of the lining of the eyelid, which never fails to increase, at last brings on a complete eversion of the part. In these cases, the cure may be accomplished with such success, as is sur-

prising to the inexperienced; for, after the fungous swelling of the internal membrane of the eyelid has been cut off, and the edge of the part approximated to the eyeball, the shortening of the eyelid, remaining after the operation, is so trivial, that it may be considered as nothing in comparison with the deformity and inconvenience occasioned by the ectropium. Whenever, therefore, the retraction of the skin of the everted eyelid, and the consequent shortness of it, are such as not to prevent its rising again and covering the eye, if not entirely, at least moderately, the surgeon should cut away the internal membrane of the everted eyelid, as already explained, so as to produce a loss of substance on the inside of the everted eyelid. This may be done most conveniently, either with the convex-edged curved scissors, or small convex-edged bistoury. In inveterate cases of ectropium, in which the tumid lining of the eyelids has become hard and callous, it is best to apply to the everted eyelid, for a few days before the operation, a soft bread and milk poultice, in order to render the part flexible, and more easily separated than it could be in its former rigid state.

The division of the cicatrices, which have given rise to the shortening and eversion of the eyelid, as Scarpa observes, does not procure any permanent elongation of this part, and consequently it is of no avail in the cure of the present disease. We see the same circumstance occur after deep and extensive burns of the skin of the palm of the hand and fingers: whatever pains may have been taken, during the treatment, to keep the hand and fingers extended, no sooner is the cicatrization thus completed, than the fingers become irremediably bent. The same thing happens after extensive burns of the skin of the face and neck. Fabricius ab Aquapendente, who well knew the inutility of making a semilunar cut in the skin of the eyelids, for the purpose of remedying their shortening and eversion, proposes, as the best expedient, to stretch them with adhesive plasters, applied to them and the eyebrow, and tied closely together. Whatever advantage may result from this practice, the same degree of benefit may be derived from using, for a few days, a bread and milk poultice, afterward oily embrocations, and, lastly, the uniting bandage, so put on as to stretch the shortened eyelid in an opposite direction to that produced by the cicatrix; a practice which Scarpa thinks should always be carefully tried, before resorting to the operation.

The patient being seated, if an adult, or placed on a table with his head a little elevated, and held by proper assistants, if a child, the surgeon, with a small convex-edged bistoury, is to make an incision of sufficient depth into the internal membrane of the eyelid, among the tarsus, carefully avoiding the situation of the puncta lachrymalia. Then he should raise with a pair of forceps, the flap of the divided fungous membrane, and continue to detach it with

the bistoury, from the subjacent parts, all over the inner surface of the eyelid, as far as where the membrane quits this part, to be reflected over the front of the eye, under the name of *conjunctiva*. The separation being thus far accomplished, the membrane is to be raised still more, with the forceps, and cut off with one, or two strokes of the scissors, at the lowest part of the eyelid. The compresses and bandage, to keep the eyelid replaced, are to be applied, as above directed. On changing the dressings, a day or two after the operation, the eyelid will be found, in a great measure, replaced, and the disfigurement, which the disease caused, greatly amended. The operation is rarely followed by bad symptoms, such as vomiting, violent pain, and inflammation. However, should they occur, the vomiting may be relieved by means of an opiate clyster, and as for the pain and inflammation, attended with great tumefaction of the eyelid operated upon, these complaints may be cured by applying a poultice, or bags filled with emollient herbs, at the same time employing internal antiphlogistics, until the inflammation and swelling have subsided, and suppuration has commenced on the inside of the eyelid, on which the operation has been done. After this, the treatment is to consist in washing the part, twice a day, with barley-water and mel rose, and, lastly, in touching the wound a few times with the *argentum nitratum*, in order to keep the granulations within certain limits, and to form a permanent cicatrix, proper for maintaining the eyelid replaced. (*Scarpa sulle Malattie degli Occhi*.)

In cases, in which the eversion is considerable, Sir W. Adams has never found the simple incision of the fungus, as practised by Scarpa, sufficient to effect a radical cure, and he therefore tried a new mode of operating. In his first attempts, he employed a very small curved bistoury, the point of which he carried along the inside of the eyelid, at its outer angle, downwards and outwards, as far as the point of reflection of the conjunctiva would admit. He then pushed it through the whole substance of the everted eyelid and its integuments, and cut upwards through the tarsus, making an incision nearly half an inch in length. With a curved pair of scissors, he next snipped off a piece of the edge of the tarsus, about one-third of an inch in width, and he afterward removed with the same instrument, the whole of the diseased conjunctiva. When the bleeding had ceased, Sir W. Adams passed a needle and ligature through the whole substance of the two divided portions, and brought them as accurately into contact as possible. Finding, however, that too much integument had been left at the lower part of the incision, he employed, in future operations, instead of the scalpel, a pair of straight scissors, with which he cut out an angular piece of the lid, resembling the letter V. Latterly, Sir W. Adams has found it advantageous to leave about a quarter of an inch of the lid adjoin-

ing its external angle, and after shortening the part as much as necessary, he brings the edges of the incision together with a suture. (See *Practical Observations on the Ectropium*, &c. by W. Adams, p. 4 and 5, Lond. 1812.)

On the subject of the foregoing proposal M. Roux observes; "What Sir W. Adams says, with a view of enhancing the value of his own method, about the frequent recurrence of ectropium, when the conjunctiva is simply cut out, is a gratuitous assertion, contradicted by experience. I have already, in a very great number of cases, undertaken the cure of ectropium in the common way: the operation always succeeded as much as the degree, or other circumstances, of the disease allowed; and I have not yet observed an instance of a relapse. (*Voyage fait à Londres en 1814, ou Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise*, p. 291.) If this new operation, however, will cure the ectropium, caused by the contraction of cicatrices, as its inventor describes, or produce great improvement, as the experience of Mr. Travers confirms, (*Synopsis of the Diseases of the Eye*, p. 235.) it is clear, that, though it may not be necessary in ordinary cases, its usefulness will not be entirely lost. The contracted scar must of course be divided, in addition to the other proceedings.

E. C. Keck de Ectropio, Tubing. 1733. Scarpa's Osservazioni sulle Malattie degli Occhi, Ed. 5, cap. 6. to which writer I am chiefly indebted for the preceding account of the Disease. Richter's Anfangsgr. der Wundarzneikunst, Band 2, p. 473, &c. Wenzel's Manuel de l'Occuliste. Pellier, Recueil d'Obs. sur les Maladies des Yeux. Sir W. Adams, Pract. Observ. on Ectropium, or Eversion of the Eyelids, with a description of a new operation for the cure of that Disease; on the modes of forming an artificial pupil; and on Cataract, 8vo. Lond. 1812. M. Bordenave, "Mémoire dans lequel on propose un nouveau procédé pour traiter le renversement des Paupières," in Mem. de l'Acad. Royale de Chirurgie, T. 13, p. 156 et seq. Edit. 12mo. It was in this memoir, that the proposal of removing a portion of the inside of the eyelid for the cure of ectropium was first made, and its efficacy illustrated by facts. Here may also be found the best historical account of the different methods of treatment, which have prevailed from the earliest periods of surgery. Consult also Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise, par P. J. Roux, p. 289—292; Paris, 1815. G. J. Beer, Lehre von den Augenkrankheiten, B. 2, p. 133, &c. 8vo. Wien. 1817. Benj. Travers, Synopsis of the Diseases of the Eye, p. 234, 356, &c. 8vo. Lond. 1820.

ECZEMA, or ECZEMA (from *εκζεω*, to boil out.), is characterized by an eruption of small vesicles on various parts of the skin, usually close, or crowded together, with little or no inflammation round their bases, and unattended by fever. It is not contagious. (Bateman's Synopsis, P. 250, Ed. 3.) There are several varieties of this disease,

the most remarkable of which is the *eczema rubrum* from the irritation of mercury. This form is attended with quickened pulse and a white tongue; but the stomach and sensorium are not materially disturbed. (See *Mercury*.)

EFFUSION. (from *effundo*, to pour out.) In surgery, means the escape of any fluid out of the vessel, or viscus, naturally containing it, and its lodgment in another cavity, in the cellular substance, or in the substance of parts. Thus, when the chest is wounded, blood is sometimes effused from the vessels into the cavity of the pleura; in cases of false aneurisms, the blood passes out of the artery into the interstices of the cellular substance; in cases of fistulae in perinaeo, the urine flows from the bladder and urethra into the cellular membrane of the perineum and scrotum; and, when great violence is applied to the skull, blood is often effused even in the very substance of the brain.

Effusion also sometimes signifies the natural secretion of fluids from the vessels; thus surgeons frequently speak of the coagulable lymph being effused on different surfaces. (See *Extravasation*.)

ELECTRICITY. Among the aids of surgery, electricity once held a conspicuous and important situation. It has, however, met with a fate, not unusual with remedies too much cried up and too indiscriminately employed; that of having fallen into an undeserved degree of neglect.

Whatever its effects may be on the system, it certainly possesses this advantage over other topical remedies, that it may be made to act on parts very remote from the surface.

Electricity, as a topical remedy for surgical diseases, is chiefly used in amaurosis, deafness, some chronic tumours, and abscesses, weakness from sprains, or contusions, paralysis, &c.

In cases of suspended animation, electricity is sometimes an important auxiliary for the restoration of the vital functions. (See J. Curry's Obs. on Apparent Death, &c. Ed. 2, 1815.)

ELEVATOR. An instrument for raising depressed portions of the skull.

Besides the common elevator, now generally preferred by all the best operators, several others have been invented; as, for instance, the tripod elevator, and another, which was first devised by M. J. L. Petit, and afterward improved by M. Louis.

The common elevator is an exceedingly simple instrument, being a mere lever, the end of which is somewhat bent, and made rough, in order that it may less readily slip away from the piece of bone, which is to be raised. This instrument may be used by forming a fulcrum for it, either in the hand, which holds it, or upon the fingers of the other hand; or the operator may make a fixed point for it on the edge of the opening made with the trephine, or of that which the accidental violence has occasioned.

One piece of the tripod elevator consists of three branches uniting above in one common trunk. The latter part is pervaded by a long screw, having below a kind of hook, and above a sort of handle for turning it. It was by means of the hook, drawn up by turning the screw, that the depressed portion of bone was elevated.

The inventors of the tripod elevator were certainly very well acquainted with the imperfections of the common one; and they endeavoured to obviate them, by procuring a firmer fulcrum, and a greater degree of power. But it was necessary to change the situation of their elevator, as often as there was occasion to raise a different portion of bone; and the hook being connected with an inflexible piece of steel, the direction of which was always the same as that of the instrument, it became troublesome and difficult to place the hook under the piece of bone, which stood in need of being raised.

These inconveniences induced J. L. Petit to contrive a new elevator, which consisted of a lever, mounted on a handle, and straight throughout its whole length, except just at its very end, which was slightly curved, in order that it might be more conveniently put under the portion of bone, which was about to be elevated. The lever was pierced at various distances from its bent end, with several holes, intended for the reception of a little kind of moveable screw-peg, which was fixed upon the top of a sort of bridge. This latter part of the instrument consisted of an arch, the ends of which were long and covered with small pads, while, on its centre, was placed the little screw-peg already mentioned. It was the intention of Petit, that the peg should be joined to the bridge by means of a hinge; and as he found that it was frequently necessary to elevate several different pieces of bone, he thought, that the peg should not be completely fastened in the hole, but that it should be capable of being moved about in any wished-for direction. With this construction, however, it was found, that the peg would only allow the lever to be applied with its edge obliquely, under the bone about to be raised, when the part of the cranium was situated to the right or left.

Louis conceived, that it would be a great improvement of Petit's elevator, if a sort of pivot were substituted for the hinge. The lever would then admit of being readily moved in every direction, and put under any point of bone, without any occasion to alter the position of the bridge or fulcrum.

I have only to add, respecting elevators for fractures of the skull, that all the best modern surgeons content themselves with the common one, which is the most simple, and, in the hands of a surgeon, who knows how to use it, is found to answer every desirable purpose.

ELYTROCELE. (from *ελυτρον*, the vagina, and *ωνειρα*, a tumour.) A hernia in the vagina.

EMBROCATIO ALUMINIS. R. Aluminis ʒij. Aceti spiritus vinosi tenuioris, sing. ℥ss. For chilblains and diseased joints.

EMBROCATIO AMMONIÆ. R. Liq. ammon. ʒi. Etheris sulphurici ʒss. Spir. Lavandulæ ʒij. M. For sprains and bruises.

EMBROCATIO AMMONIÆ ACETATÆ CAMPHORATÆ. R. Linim. Camph. Liq. ammon. acet. sing. ʒvj. Liq. Ammon. ʒss. M. For sprains, bruises, and chilblains, not in a state of supuration.

EMBROCATIO AMMONIÆ ACETATÆ. R. Liq. ammon. acet. Lin. sapon. sing. ʒj. M. For bruises, with inflammation.

EMBROCATIO LYTTE CUM CAMPHORA. R. Tinct. Lyttæ Spirit. camph. sing. ʒj. M. This may be used in any case, in which the object is to stimulate the skin. It should be remembered, however, that the absorption of lyttæ will sometimes bring on strangury.

EMBRYOTOMIA. (from *εμβρυον*, a fœtus, and *τομειν*, to cut.) The operation of cutting into the womb, in order to extract the fœtus. (See *Cæsarean Operation*.)

EMPHYSEMA. (*εμφυσημα* from *ευσωα*, to inflate.) A swelling, produced by air in the cellular substance.

The common cause of this affection is a fractured rib, by which the vesicles of the lungs being wounded, the air escapes into the cavity of the thorax. But, as the rib at the moment of its being fractured, is pushed inwards, and wounds the pleura, which lines the ribs and intercostal muscles, part of the air most commonly passes through the pleura, and the lacerated muscles into the cellular membrane, on the outside of the chest, and thence it is diffused through the same membrane over the whole body, so as to inflate it sometimes in an extraordinary degree. This inflation of the cellular membrane has been commonly looked upon, as the most dangerous part of the disease; but very erroneously, as will appear in the sequel. (*Hewson, Med. Obs. and Inquiries, Vol. 3.*)

Emphysema is most frequent after a fractured rib, because there is a wide laceration of the lungs, and no exit for the air; it is less frequent in large wounds with a knife, or broad sword, because the air has an open and unimpeded issue; it is again more frequent in deep stabs with bayonets, or small swords; and it is peculiarly frequent in gun-shot wounds, because the orifice in the skin inflames, and swells, while the wound is wider within. (*J. Bell on Wounds of the Breast, P. 265, Ed. 3.*)

The symptoms, attending emphysema, are generally of the following kind. The patient at first complains of a considerable tightness of the chest, with pain, chiefly in the situation of the injury, and great difficulty of breathing. This obstruction of respiration gradually increases, and becomes more and more insupportable. The patient soon finds himself unable to lie down in bed, and cannot breathe, unless when his

body is in an upright posture, or he is sitting a little inclined forward. The countenance becomes red and swollen. The pulse, at first, weak and contracted, becomes afterward irregular. The extremities grow cold, and, if the patient continue unrelieved, he soon dies, to every appearance suffocated.

The emphysematous swelling, wheresoever situated, is easily distinguished from œdema, or anasarca, by the crepitation, which occurs on handling it, or a noise, like that which takes place on compressing a dry bladder half filled with air. (*Encyclopédie Méthodique; Partie Chirurgicale, Art. Emphysema.*)

The tumour is colourless and free from pain. It does not of itself descend into depending parts, though by pressure it may be made to change its situation. It is elastic, that is to say, it may be pressed down, but it rises up again as soon as the pressure is discontinued. The swelling never retains the impression of the end of the finger, or, in the language of surgery, never *pits*. The part affected is not heavy. The tumour first makes its appearance in one particular place; but, it soon extends itself over the whole body, and causes an extraordinary distention of the skin. (*Richter's Anfangsgr. der Wundarzn. B. 1, p. 451.*)

The wound of the pleura and intercostals may sometimes be too small to suffer the air to get readily into the cellular membrane, and inflate it, but may confine a part of it in the cavity of the thorax, so as to compress the lungs, prevent their expansion, and cause the same symptoms of tightness of the chest, quick breathing, and sense of suffocation, which water does in the hydrops pectoris, or matter in the empyema.—(*Hewson.*)

To understand, why the air passes at all out of the wound of the lungs, we must advert to the manner in which inspiration and expiration are naturally carried on. It is well known, that in the perfect state, the surface of the lungs always lies in close contact with the membrane lining the chest, both in inspiration and expiration. The lungs themselves are only passive organs, and are quite incapable, by any action of their own, of expanding and contracting, so as to maintain their external surface always in contact with the inside of the thorax, which is continually undergoing an alternate change of dimensions. Every muscle, that has any share in enlarging and diminishing the capacity of the chest, must contribute to the effect of adapting the volume of the lungs to the cavity, in which they are contained, as long as there is no communication between the cavity of the pleura, and the external air. In inspiration, the thorax is enlarged in every direction, the lungs are expanded in the same way, and the air entering through the windpipe into the air-cells of these organs, prevents the occurrence of a vacuum.

But, in cases of wounds, when there is a free communication between the atmo-

sphere and inside of the chest, no sooner is this cavity expanded, than the air naturally enters it at the same time, and for the same reasons, that the air enters the lungs through the trachea, and the lung itself remains proportionally collapsed. When the thorax is next contracted, in expiration, the air is compressed out of the lung, and also out of the bag of the pleura, through the external wound, if there be a direct one, in which circumstance, the emphysematous swelling is never extensive.

But, in the case of a fractured rib, attended with a breach in the pleura costalis, pleura pulmonalis, and air-cells of the lungs, there is no direct communication between the cavity of the chest and the external air; in other words, there is no outward wound in the parietes of the thorax. There is, however, a preternatural opening formed between the air-cells of the lungs and the cavity of the chest, and also another one between the latter space, and the general cellular substance of the body, through the breach in the pleura costalis. The consequence is, that when the chest is expanded in inspiration, air rushes from the wound in the surface of the lungs, and insinuates itself between them and the pleura costalis. The lungs collapse in proportion, and the place, which they naturally occupied, when distended, is now occupied by the air. When, in expiration, the dimensions of the chest are every where diminished, the air, now lodged in the bag of the pleura, cannot get back into the aperture in the collapsed lung, because this is already full of air, and is equally compressed on every side, by that which is confined in the thorax. Were there no breach in the pleura costalis, this air could not now become diffused; the muscles of inspiration would next enlarge the chest, remove the pressure from the surface of the wounded lung, more air would be sucked out of it, as it were, into the space between the pleura costalis and pleura pulmonalis, and this process would go on, till the lungs of the wounded side were completely collapsed. But, in the case of a fractured rib, or narrow stab, in which there is also a breach in the pleura costalis, without any free vent outward, for the air, which gets out of the lung into the cavity of the pleura, as soon as the expiratory powers lessen the capacity of the chest, this air, not being able to pass back through the breach in the collapsed lung, is forced through the laceration, or wound, in the pleura costalis, into the common cellular substance.

It is through the communicating cells of this structure, that the air becomes most extensively diffused over the whole body, in proportion as the expiratory muscles continue in their turn to lessen the capacity of the chest, and pump the air, as it were, through the breach in the pleura costalis, immediately after it has been drawn out of the wound of the lung, in inspiration. (See *John Bell on Wounds of the Breast, and Hal-liday on Emphysema, 1807.*)

To prove that the confinement of air in the chest is the cause of the dangerous symptoms attending emphysema, Hewson adverts to the histories of some remarkable cases, published by Littré, Mery, W. Hunter, and Cheston. (See *Mem. de l'Acad. Royale des Sciences*, for 1713, *Med. Observations and Inquiries*, Vol. 2, and *Pathological Inquiries*.)

In Littré's case, the patient, who had been wounded in the side with a sword, could not breathe, without making the most violent efforts, especially during the latter part of his disease: he died on the fifth day.

In Mery's instance, the fourth and fifth true ribs were broken by a coach passing over the chest; the patient's respiration was much impeded from the first, and became more and more difficult till he died, which was on the fourth day after the accident.

In Dr. Hunter's case, the patient had received a considerable hurt on his side by a fall from his horse. He had a difficulty of breathing, which increased in proportion as the skin became elevated and tense; it was laborious as well as frequent. His inspiration was short, and almost instantaneous, and ended with a catch in the throat, which was produced by the shutting of the glottis: after this he strained to expire for a moment without any noise, then suddenly opening the glottis, he forced out his breath with a sort of groan, and in a hurry, and then quickly inspired again; so that his endeavours seemed to be to keep his lungs always full; inspiration succeeded expiration as fast as possible. He said, his difficulty of breathing was owing to an oppression or tightness across his breast, near the pit of the stomach. He had a little cough, which exasperated his pain, and he brought up blood and phlegm from his lungs. He was relieved by scarifications, and recovered.

In Mr. Cheston's case, the man had received a blow on the chest. He had a constant cough, bringing up, after many ineffectual efforts, a frothy discharge, lightly tinged with blood; he seemed to be in the greatest agonies, and constantly threatened with suffocation. His pulse was irregular, and sometimes scarcely to be felt, his face livid, and, when he was sensible, which was only now and then, he complained of a pain in his head. On passing a bandage round his chest, with a proper compress to prevent the discharge of air into the cellular membrane, and to confine the motion of the thorax, the patient cried out that he could not suffer it. A strong compression by the hand alone affected him in the same way. Notwithstanding bleeding, repeated scarifications, and other means, his sense of suffocation, and difficulty of breathing increased. On the fourth day, the air no longer passed into the cellular membrane, when on a sudden inclining his head backward, as it were, for the admission of more air than usual, his breathing became more dif-

ficult and interrupted, he turned wholly insensible, and soon afterwards died.

Littré, Mery, and Cheston, opened their patients after death.

Besides a wound of the lungs and fractured rib, Littré found a considerable quantity of blood in the cavity of the thorax, and was sensible of some fetid air escaping, on his first puncturing the intercostals and pleura. The wounded lobe was hard and black, and the other two of the same side were inflamed.

In Mery's patient, no blood was extravasated, nor was there any thing preternatural, except the fractured ribs, the wound of the pleura, and that of the lungs.

Cheston found a fracture of the tenth and eleventh ribs, and a wound of the lungs. The lungs below the wound were livid, and more compact than usual; but every thing else was natural, no extravasation, no inflammation, no internal emphysema.

Hewson made several experiments on animals, tending to prove, that air in their chests produced great difficulty in breathing, such as occurs in cases of emphysema; and, in one case, which he examined after death, air was actually discharged on puncturing the thorax.

The object of Mr. Hewson's paper is to recommend making an opening in the chest for the purpose of giving vent to the air confined in that cavity, just as is done for the discharge of pus, in cases of empyema, or of water, in those of hydrops pectoris.

In wounds of the lungs, says this author, whether occasioned by fractured ribs, or other causes, when symptoms of tightness and suffocation come on, so far should we be from dreading the emphysematous swelling of the cellular membrane, that we should rather consider it as a favourable symptom, showing that the air is not likely to be confined in the thorax; and so far should we be from compressing the wound to prevent the inflation, or emphysema, that we should rather dilate it (if not large enough already) or perform the paracentesis thoracis. We may judge of the necessity of this operation from the violence of the symptoms, such as the oppressed breathing, &c. For when these are not considerable, and the air passes out of the chest with sufficient freedom, the operation is then unnecessary.

If the disease is on the right side, the best place for performing the operation, says Mr. Hewson, will be on the forepart of the chest, between the fifth and sixth ribs; for, there the integuments are thin, and, in the case of air, no depending drain is required. But, if the disease is on the left side, it will be more advisable to make the opening between the seventh and eighth, or eighth and ninth ribs, in order that we may be sure of avoiding the pericardium. As large penetrating wounds are inconvenient on account of the air entering by the aperture in such a quantity, as to prevent the expansion of the lungs, a small wound will be eligible, especially as air does not require a large

one for its escape. Mr. Hewson recommends dissecting cautiously with a knife, in preference to the coarse and hazardous method of thrusting in a trocar.

There is one error prevailing in Mr. Hewson's paper, for which he has been justly criticised by Mr. John Bell; viz. the idea that it is possible and proper to make the collapsed lung expand by making an opening in the chest. Bromfield and B. Bell have both imbibed the same erroneous opinions, and proposed plans for exhausting the air and expanding the lung. It is very certain that it is impracticable to make the collapsed viscus expand, until the breach in it is closed, and this closure is greatly promoted by the quiet state, in which the collapsed lung remains; a state, also, the most favourable for the stoppage of any bleeding from the pulmonary vessels.

The true object then of making an opening into the thorax, when the symptoms of suffocation are violent, is not to obtain an expansion of the lung on the affected side, nor to take the pressure of the air from it; but, to remove the pressure caused on the opposite lung by the distention of the mediastinum, and, at the same time, to diminish the pressure of the air on the diaphragm. The lung on the affected side must continue collapsed, and it is most advantageous that it should do so. The opposite lung is that, which for a time must of itself carry on respiration, and it is known to be fully adequate to this function, provided the quantity of air, on the other side of the chest, does not produce too much pressure on the mediastinum, and diaphragm.

Mr. John Bell concludes his remarks on this subject, with advising the following practice:—

1st. When the crackling tumour begins to form over a fractured rib, small punctures should be made with the point of a lancet, as in bleeding; and if the point be struck deep enough, the air will rush out audibly. But, as (supposing the lung is not adherent to the inside of the chest) this air was in the thorax, before it came into the cellular substance, it is plain, that the thorax is still full, and that the lung of that side is already collapsed and useless, and must continue so. The purpose, therefore, of making these scarifications, and especially, of making them so near the fractured part, is not to relieve the lungs, but merely to prevent the air spreading more widely beneath the skin.

2d. If the air should have spread to very remote parts of the body, as to the scrotum, and down the thighs, it will be easier to make small punctures in those parts, to let out the air directly, than to press it along the whole body, till it is brought up to the punctures made on the chest, over the wounded part.

3d. If, notwithstanding free punctures, and pressing out the air in this way, you should find by the oppression, that either air, or blood, is accumulating within the cavity of the thorax, so as to oppress not the wounded

lung only, which was of course collapsed and useless from the first, but the diaphragm; and through the diaphragm to affect also the sound lung; then a freer incision must be made, through the skin and muscles, and a small puncture should be cautiously made through the pleura, in order to let out the air, or blood, confined in the thorax.—(*John Bell, Op. cit. p. 278.*)

In all these cases, copious and frequently repeated venesection is generally proper.

After a few days, the wound, in the collapsed lung, is closed by the adhesive inflammation, so that the air no longer passes out of it into the cavity of the chest, and the outer wound may therefore be healed. What air is already there is ultimately absorbed, and the lung, expanding in proportion, resumes its original functions.

The application of a bandage round the chest is sometimes practised in cases of emphysema, and its utility, when the ribs are broken, has been highly spoken of by Mr. Abernethy. "Pressure by bandage (says he) not only hinders the air from diffusing itself through the cellular substance, but serves to prevent it from escaping out of the wounded lung, and, of course, facilitates the healing of the wound, which would be prevented by the constant transmission of air. Its early application, therefore will often prevent a very troublesome symptom, whilst, at the same time, by keeping the fractured bones from motion, it greatly lessens the sufferings of the patient." (*Abernethy's Surgical Works, Vol. 2, p. 179.*) Where emphysema is complicated with a fractured rib, the latter injury is unquestionably a reason in favour of a bandage. But, whether the pressure of the roller will be useful, or hurtful, with respect to the emphysema itself, or the state of the lungs, and respiration, may be questionable. As for its tendency to resist the diffusion of air in the common cellular membrane, this circumstance does not appear to me important, because the air, thus diffused, much as it disfigures the patient, is nearly harmless, at least as long as the interlobular texture of the lungs remains uninflated; a danger, also, which no bandaging, as far as I can judge, has any tendency to prevent. Neither will a bandage have so much effect in hindering the diffusion of air, as scarifications, with this important additional consideration, that punctures, or small incisions, made over the broken rib, prevent the spreading of the air by letting it escape, while a bandage can only do so by more or less resisting its escape from the cavity of the pleura, which mode of operation in some cases would dangerously interfere with the continuation of respiration by the lung of the opposite side. At the same time, I believe, that where the air extravasated within the injured side of the chest is not in such quantity, as to oppress the sound lung, and a rib is broken, a bandage will generally afford great relief. Indeed, it is but justice to Mr. Abernethy to state, that he does not recommend the employment of a bandage

in all cases of emphysema: "Patients (says he) will not always be able to wear a bandage, when one lung is collapsed, particularly if any previous disease has existed in the other, as it equally confines the motions of the ribs on both sides, and as every possible enlargement of the chest becomes necessary for the due admission of the air into the lung, which still executes its functions. Under these circumstances, if the emphysema continues, (and its continuance must always denote that the wound in the lung is not closed,) I should esteem it the best practice to make a small opening into the chest, so that the external air might have a free communication with that cavity; and then the injured lung must remain motionless till its wound is healed, and the mediastinum, will, in every state of the thorax, preserve its natural situation." (*Abernethy, Vol. cit. p. 183.*)

Emphysema has been known to arise from the bursting of a vomica and ulceration of the surface of the lungs; but, the air which escapes, in this instance, cannot find its way into the cavity of the thorax, because the inflammation, which precedes the abscess and ulceration of the aircells, closes those which are adjacent, and produces an adhesion of the edges of the vomica, or ulcer, to the inner surface of the chest, so as entirely to separate the two cavities. We are not acquainted with any instance of the symptoms, imputed to the confinement of air in the chest, originating from suppuration and ulceration of the surface of the lungs; but, Palfyn, Dr. Hunter, and the author of the article *Emphysema*, in the *Encyclopedie Methodique, Partie Chirurgicale*, have seen cases, in which emphysema originated from abscesses of the lungs, attended with adhesion to the pleura, and ulcerations in the situation of such adhesion. In these instances, the pus having made its way through the pleura and intercostal muscles, the air escapes also through the same track, so as to pass into the cellular membrane on the outside of the chest.

A violent effort of respiration has, sometimes, produced a certain degree of emphysema, which first makes its appearance about the clavicles, and afterward spreads over the neck and adjacent parts. The efforts of labour have been known to occasion a similar symptom; but, no bad consequences followed. (*Medical Communications, Vol. 1, p. 176; Blackden in Med. Facts and Experiments, Vol. 2, and Wilmer's Obs. in Surgery, p. 143.*)

Louis has described an emphysema of this sort, which, on account of its cause, and the indication which it furnishes to the practitioner, is highly important. This famous surgeon had occasion to remark it in a young girl, who died suffocated, from a bean falling into her windpipe, and he considers it, as a pathognomonic symptom of such an accident, concerning the existence of which it is so essential not to commit any mistake. (*See Bronchotomy.*) This emphysema made its appearance on both sides of the neck, above the clavicles, and came on

suddenly, on the third day after the accident. The inspection of the body proved, that the lungs and mediastinum were also in an emphysematous state. The retention of the air, confined by the foreign body, produced, says Louis, at each attempt to expire, and, especially, when the violent fits of coughing occurred, a strong propulsion of this fluid towards the surface of the lung, into the spongy substance of this viscus. Thence, the air passed into the cellular texture, which unites the surface of the lung to the pleura pulmonalis; and, by communications from cells to cells it caused a prodigious swelling of the cellular substance, between the two layers of the mediastinum. The emphysema, increasing, at length made its appearance above the clavicles. This tumefaction of the lung, and surrounding parts, in consequence of air getting into their spongy and cellular texture, is an evident cause of suffocation, and the swelling seems so natural an effect of the presence of a foreign body in the trachea, that one can hardly fail to think it an essential symptom, though no author has made mention of it. (*Mém. de l'Acad. de Chir. Tom. 4, in 4to.*) The emphysematous swelling, sometimes formed in the axilla, in the reduction of a dislocated shoulder, (*See Dislocation*) was accounted for by Desault and Bichat, on the same principle as the foregoing case, viz. a rupture of one of the air-cells, by the patient's efforts to hold his breath during the reduction of the bone. How far the explanation of the cause may be true, has been questioned. (*See Dict. des Sciences Med. T. 12, p. 15;*) the fact itself admits of no doubt, and is both curious and interesting.

An emphysematous swelling of the head, neck, and chest, has also been noticed in typhoid fevers. Dr. Huxham relates an instance of this sort, in a sailor of a scorbutic habit. (*Medical Observations and Inquiries, Vol. 3, Art. 4.*) A case of spontaneous emphysema has likewise been described by Dr. Baillie. (*See Trans. of a Soc. for the Improvement of Med. and Chir. Knowledge, Vol. 1, p. 202.*)

A curious example of what has been called a spontaneous emphysema, is recorded by Mr. Allan Burns: "The patient was a strong athletic man, who, about six years previous to his application at the Royal Infirmary, had received a smart blow on the neck, from the keel of a boat. This injury was soon followed by the formation of a firm tense tumour on the place which had been hurt. The swelling increased very slowly, during the five years immediately succeeding its commencement; but, during the sixth, it received a very rapid addition to its bulk. At this time, it measured nearly six inches in diameter, seemed to be confined by a firm and dense covering, and the morbid parts had an obscure fluctuation. From the first to the last, the tumour had been productive of very little pain.

"Judging from the apparent fluctuation, that the tumour was encysted, it was resolved, at a consultation, to puncture the swelling, draw off its contents, and then pass

a seton through it. By plunging a lancet into it, only a very small quantity of blood, partly coagulated, and partly fluid, was discharged,—a quantity so trifling, that, after its evacuation, the size of the tumour was not perceptibly reduced. A seton was passed through the swelling. At this time the man was in perfect health.

"About ten hours after the operation, the patient was seized with extremely violent rigours, followed by heat, thirst, pain in the back, excessive pain in the tumour, and oppressive sickness.

"An emetic was prescribed, but, instead of producing vomiting, it operated as a cathartic. To remove the irritation the seton was withdrawn. The pain in the tumour, however, and the general uneasiness continued to increase, and thirty hours subsequent to making the puncture, air began to issue from the track of the seton; and, afterward the cellular membrane of the neck, and of the other parts of the body in succession, became distended with a gaseous fluid. In the course of a few hours, after the commencement of the general emphysema, the man died.

"Twelve hours after death, when the body was free from putrefaction, it was inspected. The emphysema was neither increased, nor diminished since death, and some idea may be formed of its extent, when the scrotum was distended to the size of the head of an adult. Even the cavities of the heart, and the canals of the blood-vessels, contained a considerable quantity of air. We could discover no direct communication between the tumour and the trachea or lungs, although such was carefully sought for." (*A. Burns on the Surgical Anatomy of the Head and Neck*, p. 51—53.)

From such cases, we may infer, with the preceding writer, that from the mere rupture of a few of the bronchial cells, occasioned by irregular action of the lungs, or by some other internal cause, a spontaneous diffusion of air may take place in the cellular texture of the body. Such examples are dependent on the same cause as the emphysema from injury of the lungs; only the rupture of the bronchial cells in the former cases is less obvious.

Surgeons often observe a partial emphysema in cases of gangrene. Here, however, it is hardly necessary to observe, the air is the product of putrefaction, and the disorder has not the smallest connexion with any injury, or disease of the air-cells of the lungs.

The reader may consult with advantage, *l'Encyclopédie Méthodique, Partie Chirurgicale*. C. C. Puyssch, *De Emphysemate* (Haller. *Disp. Chir.* 2: 567, Halæ, 1733. H. A. Nies, *De Miro Emphysemate*, Alo. Duisb. ad Rhen. 1751. Hewson's *Paper in Medical Observations and Inquiries*, Vol. 3. *Mém. de l'Acad. Royale des Sciences*, for 1713. Dr. Hunter, in *Medical Observations and Inquiries*, Vol. 2, Cheston, in *Pathological Inquiries*. Abernethy's *Surgical Works*, Vol. 2. Richter von der *Windgeschwulst*, in *Anfangsgr. der Wundarz-*

neykunst, Band 1, p. 451, &c. John Bell on *Wounds*, Ed. 3. Edinb. 1812. Halliday on *Emphysema*, 1807. Allan Burns on the *Surgical Anatomy of the Head and Neck*, p. 52, &c. *Trans. of a Society for the Improvement of Medical and Chir. Knowledge*, Vol. 1, p. 262. Wilmer's *Observations in Surgery*, p. 143. F. C. Waitz, *De Emphysemate*, Alo. Lips. 1803. Richerand *Nosographie Chirurgicale*, Tom. 4, p. 164, Edit. 2. Lassus *Pathologie Chirurgicale*, Tom. 2, p. 321, &c. Edit. 1809. *Dict. des Sciences Méd.* T. 12, p. 1, &c. J. Hennen, *Principles of Mil. Surgery*, p. 376. Ed. 2, 8vo. Edinb. 1820. C. Bell, *Surgical Obs.* Vol. 1, p. 161, &c.

EMPLASTRUM AMMONIACI CUM ACETO. R. Ammoniaci purif. ℥ij. Acidi Acetici ℥ij. Ammoniacum in aceto liquefactum evaporata in vase ferreo ad emplastrum crassitudinem.

EMPLASTRUM AMMONIACI SCILLITICUM. R. Gum. ammoniaci ℥j. Aceti Scillitici, q. s. ut fiant emplastrum, quo pars affecta tegatur.

Mr. Ford found this last plaster useful in some scrofulous affections. It may be rendered more stimulating by sprinkling it with squills. (*Ford on the Hip-joint*, p. 59.) It was recommended by Swediaur; *London Medical Journal*, Vol. 1, p. 198.

EMPLASTRUM AMMONIACI CUM HYDRARGYRO. Discutient.

EMPLASTRUM AMMONIACI CUM CICUTA. R. Gum. ammon. ℥ij. Extracti Conii ℥j. Liq. Plumb. acet. ℥j.

Dissolve the ammoniacum in a little vinegar of squills, then add the other ingredients, and boil them all slowly to the consistence of a plaster. Discutient.

EMPLASTRUM AMMONIÆ. R. Sapon. ℥ij. Emplast. Plumbi. ℥ss. Ammon. mur. ℥j.

The two first articles are to be melted together, and when nearly cold, the muriated ammonia, finely powdered, is to be added. This plaster stimulates the skin, excites the action of the absorbents, and disperses many chronic swellings and indurations.

EMPLASTRUM CANTHARIDIS. (See *Blister*.)

EMPLASTRUM GALBANI COMPOSITUM. L. P. (*Olim emplastrum lithargyri comp.*) Properties discutient.

EMPLASTRUM HYDRARGYRI. L. P. (*Olim emplastrum litharg. cum hydrargyro.*) Properties discutient.

EMPLASTRUM LYTÆ. L. P. (See *Blister*.)

EMPLASTRUM PLUMBI. L. P. (*Olim emplastrum lithargyri, or diachylon plaster.*)

EMPLASTRUM RESINÆ. L. P. *Olim emplastrum lithargyri cum resina.* The common adhesive, or sticking plaster.

EMPLASTRUM SAPONIS. The plaster commonly used for fractures. It is also frequently applied to bruised parts, and to many indurations of a chronic nature.

EMPHYEMA. (from *ev*, within, and *πύς*, pus, or matter.) A collection of purulent matter in the cavity of the chest.

The ancients made use of the word, "em-

pyema" to express every kind of internal suppuration. It was Ætius who first restricted the term to the collections of matter, which sometimes form in the cavity of the pleura, or membrane lining the chest; and all the best modern surgeons invariably attach this meaning alone to the expression.

The operation for empyema properly means the making of an opening into the thorax, for the purpose of giving vent to the matter, collected in the cavity of the pleura, though the phrase with several writers denotes making an incision into the chest, in order to let out any effused, or confined fluid, whether matter, blood, an aqueous fluid, or even air. The necessity for having recourse to such an operation, however, does not often present itself. I would not wish to be supposed to assert, that inflammation of the lungs, pleura, mediastinum, diaphragm, and even of the liver, does not sometimes terminate in suppuration. Certainly, the latter event is occasionally produced; but, when it does happen, the matter does not always make its way into the cavity of the chest: frequently external abscesses form, or the pus is either coughed up, or discharged with the stools.

Acute and chronic abscesses not unfrequently form in the cellular substance, between the pleura and the ribs and intercostal muscles. A swelling occurs between two of those bones; the skin does not undergo any change of colour; a fluctuation is distinguishable, and sometimes an extensive oedema is observable.

With respect to abscesses, formed in the cellular substance, connecting the pleura costalis to the intercostal muscles, they rarely burst into the chest, the pleura always being considerably thickened. However, in order to keep them from spreading extensively, as well as to obviate any possibility of their breaking inwards, the best rule is to make an early, and, if possible, a depending opening. The motions of respiration then both promote the exit of the matter, as well as the contraction of the cavity, in which it was lodged; and the disease, if unattended with caries, generally terminates favourably.

It often happens, however, that the ribs are carious, and then the cure is more tedious and difficult. A modern writer, indeed, informs us, that, when the inside of the rib is extensively carious, or when the caries is near the junction of the bone to the spine, the fistula is incurable. (*Lassus Pathologie Chirurgicale*, Tom. 1, p. 128, Edit. 1809.) On the other hand, another surgeon of vast experience recommends us to endeavour to separate the diseased bone, either by cutting it away, or employing the trepan. (*Pelletan Clinique Chir.* T. 3, p. 253.) Were a part of a diseased rib to admit of being sawn away, Mr. Hey's convex saw would be a more proper instrument for the purpose, than a trepan.

An abscess of the preceding kind may be so situated, and attended with such a pulsation, as greatly to resemble an aneu-

rism of the origin of the aorta. An interesting case of this description is detailed by Pelletan. (*Clinique Chir.* T. 3, p. 254,) and another was seen by Baron Boyer. (*Traité des Mal. Chir.* T. 7, p. 333.)

When the surface of the lungs and that of the pleura costalis have become adherent to each other, in the situation of the abscess, so as to constitute what is termed *encysted empyema*, the pus, disposed by a law of nature to make its way to the surface of the body, generally occasions ulceration of the intercostal muscles, and collects on the outside of them. An abscess of this kind comes on with a deep-seated pain in the part affected; an oedematous swelling, which retains the impression of the finger; and a fluctuation, which is at first not very distinct, but, from day to day, becomes more and more palpable, and, at length, leads the surgeon to make an opening.

If this be not done when the fluctuation becomes perceptible, the abscess may possibly insinuate itself into the cavity of the pleura, in consequence of the adhesion being in part destroyed by ulceration. Sabatier affirms, that the case may take this course, even when the abscess has been punctured, and while a free external opening exists; and this experienced surgeon has adduced a fact in confirmation of such an occurrence. (*See Médecine Opératoire*, Tom. 2, p. 249.)

In a few instances, the surface of the lung ulcerates, and the matter is voided from the trachea. But in the majority of examples, the pus makes its way outwards, through the pleura costalis. If inflammation occurs in the anterior mediastinum, and ends in suppuration, the abscess may possibly burst into neither of the cavities of the chest; but, make its way outward, after rendering the sternum carious, as happened in the example recorded by Van Swieten. (*Comment. on Boerhaave's 895th Aphorism.*)

But, though collections of matter in the anterior mediastinum are influenced by the general law, whereby abscesses in general tend to the surface of the body, and though it be true, that they rarely burst inwardly into the cavity of the pleura, the contrary may happen, as is proved by the 9th case in La Martinière's memoir on the operation of trepanning the sternum. Here the event was the more extraordinary, as there was already an external opening in the abscess.

External injuries, such as the perforation of the sternum with a sword, (*Vanderwel, Obs.* 29, Cent. 1.) a contusion, a fracture, or a caries of this bone, may give rise to an abscess in the anterior mediastinum. Galen has recorded a memorable example, where the abscess was the consequence of a wound of the forepart of the chest. After the injury, which was in the region of the sternum, seemed quite well, an abscess formed in the same situation, and being opened healed up. The part, however, soon inflamed and suppurated again. The abscess could not now be cured. A consultation was held, at which Galen attended. As the sternum was

obviously carious, and the pulsation of the heart was visible, every one was afraid of undertaking the treatment of the case, since, it was conceived, that it would be necessary to open the thorax itself. Galen, however, engaged to manage the treatment, without making any such opening, and he expressed his opinion, that he should be able to effect a cure. Not finding the bone so extensively diseased, as was apprehended, he even indulged considerable hopes of success. After the removal of a portion of the bone, the heart was quite exposed (as is alleged,) by reason of the pericardium having been destroyed by the previous disease. After the operation, the patient experienced a speedy recovery.

J. L. Petit met with an abscess in the anterior mediastinum, in consequence of a gunshot wound in the situation of the sternum. The injury had been merely dressed with some digestive application; no dilatation, nor any particular examination of the wound had been made. The patient, after being to all appearances quite well, and joining his regiment again, was soon taken ill with irregular shiverings, and other febrile symptoms. Petit probed the wound, and found the bone affected. As there was a difficulty of breathing, he suspected an abscess either in the diploe, or behind the sternum, and, consequently, he proposed laying the bone bare, and applying a trepan. This operation gave vent to some sanious matter, and, as soon as the inner part of the sternum was perforated, a quantity of pus was discharged. The patient was relieved, and afterward recovered. (*Petit, Traité des Mal. Chir. T. 1, p. 80.*)

Another instance, in which an abscess behind the sternum was cured by making a perforation in that bone opposite the lower part of the cavity, in which the matter collected, is recorded by De la Martinière. (*Mém. de l'Acad. de Chir. T. 12, Ed. 12mo.*)

When, in consequence of inflammation, an abscess forms deeply in the substance of the lungs, the pus more easily makes its way into the air-cells, and tends towards the bronchiæ, than towards the surface of the lungs. In this case, the patient spits up purulent matter. When the opening, by which the abscess has burst internally, is large, and the pus escapes from it in considerable quantity at a time, the patient is in some danger of being suffocated. However, if the opening be not immoderately large, and the pus, which is effused, be not too copious, a recovery may ensue. Abscesses in the substance of the diaphragm, and collections of matter in the liver, may also be discharged by the pus being coughed up from the trachea, when the parts affected become connected with the lungs by adhesions, and the abscesses of the liver are situated on its convex surface. When the collection of matter in the liver occupies any other situation, the abscess frequently makes its way into the colon, and the pus is discharged with the stools. Several cases of this kind are related by authors: Sabatier has recorded two

in his *Médecine Opératoire*; Le Dran makes mention of others; and Pemberton, in his book on the Diseases of the Abdominal Viscera, p. 36, relates additional instances of a similar nature.

I shall now proceed to the consideration of empyema strictly so called. Sometimes it is a consequence of a penetrating wound of the chest; occasionally it proceeds from the bursting of one or more vomicæ; in a few examples, it arises from the particular way, in which abscesses of the liver burst; (*Journ. de Med. T. 3, p. 47. Morgagni, Epist. 30, art. 4.*) but in the greater number of instances, it originates from pleuritic inflammation, especially that of the chronic kind. (*Boyer, Traité des Mal. Chir. T. 7, p. 352.*) Empyema very rarely takes place in both sides of the chest, but is almost always limited to one cavity of the pleura.

According to Baron Boyer, when empyema arises from thoracic inflammation, pleuritis, or pneumonia, the symptoms, characterizing it, are always preceded by those of the disease, of which the effusion of pus upon the diaphragm is the effect. Inquiry must therefore be made, whether the patient has pleurisy, or peripneumony, the symptoms of which have lasted longer than a fortnight; and whether, after a transient amendment, there have been frequent shiverings, followed by a low continued fever, with nightly exacerbations. Now, these first circumstances justify the belief, that the inflammatory disorder has terminated in suppuration, and that the symptoms afterward experienced, depend upon effusion of matter in the chest. Some of these arise from the mechanical action of the pus upon the lungs, heart, and parietes of the chest, and belong also to other effusions in the thorax; the rest may be said to be the effects of ulceration and suppuration of the parts on the animal economy, and therefore, particularly belong to empyema.

First, of the common symptoms, respiration is difficult, short, and frequent; the patient suffers great oppression, and experiences a sense of suffocation, and of weight upon the diaphragm. He cannot move about, even for a short time, without being quite out of breath, and threatened with syncope. He has an almost incessant, and very fatiguing cough, which is sometimes dry, sometimes attended with expectoration. (*Boyer, Traité des Mal. Chir. T. 7, p. 356.*)

No surgical writer, with whom I am acquainted, has treated with more discrimination, than Mr. Samuel Sharp, of the symptoms produced by collections of matter in the chest. He remarks, that it has been almost universally taught, that, when a fluid is extravasated in the thorax, the patient can only lie on the diseased side, the weight of the incumbent fluid on the mediastinum becoming troublesome, if he places himself on the sound side. For the same reason, when there is fluid in both cavities of the thorax, the patient finds it most easy to lie on his back, or to lean forwards, in order that the fluid may neither press upon the mediasti-

num, nor the diaphragm. But, it is noticed by Mr. Sharp, that, however true this doctrine may prove in most instances, there are a few, in which, notwithstanding the extravasation, the patient does not complain of more inconvenience in one posture than another, nor even of any great difficulty of breathing. (See *Le Dran's Obs.* 217, and *Marchetti*, 65.)

On this account, observes Mr. Sharp, it is sometimes less easy to determine, when the operation is requisite, than if we had so exact a criterion, as we are generally supposed to have. But, says he, though this may be wanting, there are some other circumstances, which will generally guide us with a reasonable certainty. He states, that the most infallible symptom of a large quantity of fluid in one of the cavities of the thorax, is a preternatural expansion of that side of the chest, where it lies; for, in proportion as the fluid accumulates, it will necessarily elevate the ribs on that side, and prevent them from contracting so much in expiration as the ribs on the other side. This change is said to be most evident, when the surgeon views the back of the chest. (*Boyer, Vol. cit. p. 357.*) Mr. Sharp also refers to *Le Dran's Obs.* 211, vol. I, in order to prove, that the pressure of the fluid on the lungs may sometimes be so great, as to make them collapse, and almost totally obstruct their function. When, therefore, says Mr. Sharp, the thorax becomes thus expanded, after a previous pulmonary disorder, and the case is attended with the symptoms of a suppuration, it is probably owing to a collection of matter. The patient, he observes, will also labour under a continual low fever, and a particular anxiety from the load of fluid.

Besides this dilatation of the cavity by an accumulation of the fluid, the patient will be sensible of an undulation, which is sometimes so evident, that a bystander can plainly hear it in certain motions of the body. Mr. Sharp adds, that this was the case with a patient of his own, on whom he performed the operation; but the fluid in this instance, he says, was very thin, being a serous matter, rather than pus. Sometimes, when the practitioner applies his ear close to the patient's chest, while this is agitated, a noise can be heard, like that produced by shaking a small cask, not quite full of water. (See *Dr. Archer's Case in Trans. of the Fellows, &c. of the King's and Queen's College of Physicians in Ireland, Vol. 2, p. 2.*) In this instance, the fluid resembled whey.

According to the same author, it will also frequently happen, that though the skin and intercostal muscles, are not inflamed, they will become œdematous in certain parts of the thorax; or, if they are not œdematous, they will be a little thickened; or, as *Boyer* states, the intercostal spaces are widened, and, when the empyema is considerable, instead of being depressed, as they are in thin persons, they project beyond the level of the ribs. (*Mal. Chir. T. 7, p. 357.*) These symptoms, joined with the enlargement of the thorax, and the preceding affection of

the pleura, or lungs, seem unquestionably to indicate the propriety of the operation. But, observes Mr. Sharp, among other motives to recommend it upon such an emergency, this is one, that if the operator should mistake the case, an incision of the intercostal muscles would neither be very painful, nor dangerous. (See *Critical Inquiry into the present State of Surgery, sect. on Empyema.*)

"The difficulty of lying on the side, opposite to the collection of pus," says *Le Dran*, "is always accounted a sign of an empyema. This sign, indeed, is in the affirmative; but, the want of it does not prove the negative; because, when there is adhesion of the lungs to the mediastinum, the patient may lie equally on both sides." (*Le Dran's Obs. p. 108, Edit. 2.*) The explanation of this circumstance, offered by *Le Dran*, is, that when the cyst, in which the matter is contained, is between the mediastinum and the lungs, the mediastinum gradually yields to the volume of the pus, in proportion as it is formed, and the cyst in which it is contained becomes dilated; "whence habitude becomes a second nature." Whereas, in an empyemal person, in whom the lung is not adherent to the mediastinum, and who lies on the side opposite to that, on which the collection of pus is situated, the mediastinum is on a sudden loaded with an unusual weight of fluid. (*P. 111.*)

Richerand contends, that the difficulty of breathing which patients with extravasated fluid in the chest experience in lying upon the side, opposite to that on which the disease is situated, never originates, as has been commonly taught and believed, from the fluid pressing upon the mediastinum and opposite lung. "I have (says he) produced artificial cases of hydrothorax, by injecting water into the thorax of several dead subjects, through a wound made in the side. This experiment can only be made on subjects, in which the lungs are not adherent to the parietes of the chest. In this way, from three to four pints of water were introduced. I then cautiously opened the opposite side of the chest: the ribs and lungs being removed, the mediastinum could be distinctly seen, reaching from the vertebræ to the sternum, and supporting, without yielding, the weight of the liquid, in whatever position the body was placed.

"It is evident, then, that patients, with thoracic extravasations, lie on the diseased side, in order not to obstruct the dilatation of the sound side of the respiratory organs, one part of which is already in a state of inaction. It is for the same reason, and in order not to increase the pain by the tension of the inflamed pleura, that pleuritic patients lie on the diseased side. The same thing is observable in peripneumony; in a word, in all affections of the parietes of the chest." (*Richerand, Nosogr. Chir. T. 4, p. 168, 169. Edit. 2.*)

It appears to me, that there may be some truth in the foregoing statement; but the experiments are far from being conclusive,

with respect to the assertion, that, in cases of empyema, hydrothorax, &c. the fluid on one side of the chest does not compress the opposite lung. In the first place, the quantity of fluid is frequently much larger than that which Richerand injected. Secondly, although the mediastinum may not be apt to yield at once to the weight of a liquid suddenly injected into one side of the thorax; yet, it may do so by the gradual effect of disease. Thirdly, many of the phenomena of empyema seem adverse to Richerand's inference.

Although surgeons should be aware, that patients with empyema can sometimes lie in any position, without particular aggravation of the difficulty of breathing, yet it ought to be distinctly understood, that the generality of patients with this disease cannot place themselves on the side, opposite to that, on which the collection of pus is situated, without having their respiration very materially obstructed. Another circumstance, also, which deserves to be mentioned while we are treating of the symptoms of empyema, is, that the œdema of the integuments is sometimes not confined to the thorax, but extends to more remote parts, on the same side of the body as the collection of matter. Both the foregoing remarks are confirmed by an interesting case, which has been published by Mr. Hey of Leeds.

Sept. 3, 1788, Mr. Hey was desired to visit John Wilkinson, who had been ill ten days of the influenza. The patient was found labouring under a fever, attended with cough, difficulty of breathing, and pain in the left side of the thorax. He was bled once; had repeated blisters applied to the chest; and took nitre and antimonials, with a smooth linctus to allay his cough. He was repeatedly relieved by these means, especially by the application of the blisters; but repeatedly relapsed. At last, he became so ill, that he breathed with the utmost difficulty, and "could not lie on the right side, without danger of immediate suffocation."

Mr. Hey found the patient in the state, just now described, on the 17th of September. "His face, and especially his eyelids, were a little swollen on the left side." The left side of the thorax was larger than the right, and its integuments were œdematous. Upon pressing the intercostal muscles, they felt distended; they yielded a little to a strong pressure, but rebounded again. The abdomen, especially at its upper part, appeared to be fuller than in the natural state. (See *Hey's Practical Obs. in Surgery*, p. 476.) This last symptom is also particularly noticed by Boyer. (*Mal. Chir. T. 7. p. 357.*)

Another remarkable symptom, which is occasionally produced by collections of matter in the chest, is an alteration in the position of the heart. I have seen a patient in St. Bartholomew's Hospital, who had so large a quantity of matter in the left bag of the pleura, that it completely displaced the heart, which pulsated against the inside of the chest, at a considerable distance to the right of the sternum. This man's life might probably have been saved, had paracentesis tho-

racis been performed in time. Some suspected an aneurism from the throbbing on the right of the sternum; and the case was not fully understood till after death, when the body was opened. A little attention to the symptoms, however, might have convinced any man of moderate understanding, that it was an empyema, and that making an opening, for the discharge of the matter, afforded the only rational chance of preserving life. There had been pain and inflammation in the chest, followed by shiverings; there was very great difficulty of breathing; the heart, which previously used to beat in the usual place, no longer did so; but now, pulsated on the right side of the thorax.

That the heart should be displaced in this manner by any large collection of fluid in the right cavity of the thorax, one would naturally expect; but it is an occurrence, that has not been much noticed by surgical writers. Baron Larrey, however, has related a highly interesting case, where the heart was not only pushed considerably to the right of the sternum, but its action was so much impeded by the derangement of its position, that the pulse in the large arteries was thereby rendered extremely feeble. In this instance, also, the diaphragm had descended so low down, as to force some of the small intestines into the cavity of the pelvis. (*Mémoires de Chirurgie Militaire*, T. 3. p. 447, &c.) Pelletan has also recorded an example, in which a collection of fluid in the left cavity of the chest displaced the heart, the pulsations of which were perceptible betwixt the third and fourth ribs of the right side, near the sternum. (*Clinique Chir. T. 3. p. 276.*) Baron Boyer speaks of one case, in which the displacement of the heart was so extensive, that its pulsations were felt near the right axilla. (*Traité des Mal. Chir. T. 7. p. 357.*) In the anatomical collection at Strasburgh, is also a preparation exhibiting the displacement of the heart into the right side of the chest, by matter in the left pleura, the left lung being nearly annihilated. (*Lobstein compte de son Museum Anat. p. 39. 8vo. 1820.*) The heart is sometimes thrust downwards by collections of fluid in the chest, and its pulsation is distinguishable in the epigastrium. (*Hodgson on the Diseases of Arteries and Veins*, p. 95.)

When the cavity of the pleura contains fluid, and the surgeon strikes the thorax repeatedly with the ends of his fingers, a dull sound is said to be produced, quite different from what would occur, were the chest in its natural state. But, as Boyer remarks, this symptom, to which so much importance has of late been attached, being common to extravasations in the thorax, and several other diseases, will not denote empyema, unless combined with other signs of this affection. Nor will any useful information be derived from the above percussions, except the practitioner has had a good deal of experience in them, and they are repeatedly practised with the patient in different positions. (*Mal. Chir. T. 7. p. 357.*)

The symptoms of empyema are frequently very equivocal, and the existence of the

disease is generally somewhat doubtful. Pannarolius opened a man, whose left lung was destroyed, at the same time that the thorax contained a considerable quantity of pus. Although the patient had been ill for two months, he had suffered no difficulty of breathing, and had had only a slight cough. Le Dran met with a case of nearly the same kind. A patient, who had been for three days affected with a considerable oppression, and an acute pain on the left side of the chest, got somewhat better. He felt no material difficulty of breathing, on whatever side he lay. The only thing which he complained of, was a sense of fluctuation in his thorax, and a little obstruction of his respiration, when he was in a sitting posture. These symptoms did not seem sufficiently decided to justify the operation, and it was delayed. The febrile symptoms continued with cold sweats, and the patient died on the eighth day. Five pints of pus were found collected in the chest. (See *Le Dran's Observations in Surgery*, p. 109, 110, *Edit.* 2.)

The symptoms, more particularly depending upon empyema itself, that is to say, upon the disease and suppuration within the chest, are nearly the same as those, which accompany all large deep-seated abscesses. The fever, attending the thoracic inflammation, which ends in suppuration, gradually diminishes, but does not entirely cease. On the contrary, it soon changes into hectic, attended with flushings of the cheeks, heat of the palm of the hands, and exacerbations every evening, and after meals. In the night, the upper parts of the body are covered with perspiration; the patient is tormented with insatiable thirst; his appetite quite fails; his debility becomes extreme; he is subject to frequent fainting fits; diarrhoea ensues; and the finger nails become curved, shining, and of the yellow tinge, observable all over the body. At length, the utmost emaciation, and the facies Hippocratica come on, frequently attended with dilated pupils, and enfeebled vision, and indicating the approach of death.

As the operation of empyema, and some other particulars, relating to this subject, are treated of in another part of this Dictionary, (See *Paracentesis of the Thorax*) it will only be necessary for me here to subjoin a list of works, which may be advantageously consulted for information on empyema. *A Vater, et J. E. Mutillet, Emphyema, e vomica pulmonis, rupta in cavitate pectoris dextram effusa, indique pulmo hujus lateris compressus penitusque ab officio remotus, Wittemb. 1731, (Haller, Disp. ad Morb. 2, 4031.) Gerardus de Maire, Diss. de Emphyemate, 4to. Lugd. 1735. Sharp's Critical Inquiry into the Present State of Surgery, sect. on Emphyema. Le Dran's Observations in Surgery. J. L. Petit, Traité des Maladies Chirurgicales, Tom. 1. Chap. 3. Des Plaies de la Poitrine. Warner's Cases in Surgery, Chap. 6. *Edit.* 4. Mémoire sur l'Opération du Trépan au Sternum, par M. de la Martinière in Mém. de l'Acad. Royale de Chirurgie, Tom. 12, p. 342, *Edit.* 12mo. L. G. Van Malcote, De Emphyemate, Tenermond. 1783. Sabatier, Médecine Opératoire.*

Tom. 2. p. 247, &c. *Edit.* 1. A. O'Flaherty, De Emphyemate, Montp. 1774. Andouard de l'Emphyeme, Cure Radicale Obtenue par l'Opération, &c. 8vo. Paris, 1808. Callisen, Systema Chirurgiæ Hodiernæ, Vol. 2, p. 363. *Edit.* 1798. Flajani, Collezione d'osservazioni, &c. di Chirurgia, T. 3. p. 185, &c. 8vo. Roma, 1820. Richerand, Nosogr. Chir. T. 4, sect. des Maladies de l'Appareil respiratoire. Leveillé, Nouvelle Doctrine Chir. T. 2. p. 575, &c. Hey's Practical Observations in Surgery, *Ed.* 3. Lassus Pathologie Chirurgicale, T. 1, p. 122, &c. Larrey, Mémoires de Chirurgie Militaire, T. 3. p. 442, et T. 4. p. 356, &c. Pelletan, Clinique Chir. T. 3, p. 236, &c. J. Hennen, Principles of Military Surgery, p. 384, &c. *Ed.* 2. 8vo. Edinb. 1820. Boyer, Traité des Mal. Chir. T. 7. p. 351, &c. 8vo. Paris, 1821.

ENCANTHIS. (from *en*, and *καυος*, the angle of the eye.)

The encanthis, at its commencement, is nothing more, says Scarpa, than a small, soft, red, and sometimes rather livid, excrescence, which grows from the caruncula lachrymalis, and, at the same time, from the neighbouring semilunar fold of the conjunctiva. The inveterate encanthis is ordinarily of considerable magnitude; its roots extend beyond the caruncula lachrymalis, and semilunar fold, to the membranous lining of one or both eyelids. The patient experiences very serious inconvenience from its origin, and interposition between the commissure of the eyelids, which it necessarily keeps asunder, on the side towards the nose.

The encanthis keeps up a chronic ophthalmia, impedes the action of the eyelids, and in particular, prevents the complete closure of the eye. Besides, partly by compressing, and partly by displacing the orifices of the puncta lachrymalia, it obstructs the free passage of the tears into the nose.

According to Scarpa, this excrescence, on its first appearance, is commonly granulated, like a mulberry, or is of a ragged and fringed structure. Afterward, when it had acquired a certain size, one part of it represents a granulated tumour, while the rest appears like a smooth, whitish, or ash-coloured substance, streaked with varicose vessels, sometimes advancing as far over the conjunctiva, covering the side of the eye next to the nose, as where the cornea and sclerotica unite. In this advanced state, the encanthis constantly interests the caruncula lachrymalis, the valvula semilunaris, and the membranous lining of one, or both eyelids. In addition to the roots, which in such circumstances connect the excrescence with the caruncula lachrymalis, the semilunar fold, and the conjunctiva of the globe of the eye, the encanthis emits an appendage, or prominent, firm elongation, along the inside of the upper, or lower eyelid, in the direction of its edge. The middle, or body, of the encanthis, divides near the cornea, as it were, like a swallow's tail, to form two appendages, or elongations, one of which extends along the inner surface of the upper eyelid by the margin of which it is covered, while the other shoots in a direction from the

internal towards the external angle, along the inside of the lower eyelid, which also conceals it beneath its edge.

The body of the encanthis, or that middle portion of the whole excrescence which reaches from the caruncula lachrymalis, and semilunar fold, inclusively, over the conjunctiva almost to the junction of the sclerótica with the cornea, sometimes forms a prominence, as large as a small nut, or chestnut. At other times, it is of considerable size, but depressed and broken down, as it were, at its centre. Still, however, the body of the encanthis preserves that granulated appearance which prevailed at first; while one or both the appendages, on the inside of the eyelids, appear rather like a fleshy than a granulated substance.

On turning out the inside of the eyelids, these appendages, or elongations of the encanthis, form a prominence projecting forward. When both eyelids are equally affected, and turned inside out, the appendages conjointly represent, as it were, a ring, the back of which rests on the globe of the eye.

Sometimes, the encanthis assumes a cancerous malignancy. This character is evinced by the dull-red, leaden, or (as Beer says) the bluish red colour of the excrescence; by its excessive hardness, and the lancinating pains which occur in it, and extend to the forehead, the whole eyeball, and the temple, especially when the tumour has been slightly touched. It is also evinced by the propensity of the excrescence to bleed, by the partial ulcerations on its surface, which emit a fungous substance, and a thin and exceedingly acrid discharge. The disease is constantly attended with epiphora, and preceded by a scirrhus induration of the caruncle. The eyeball and neighbouring bones, which are of a spongy texture, are said to participate very soon in the disease, the lower eyelid also becoming everted. (Beer, *Lehre von den Augenkr.* B. 2, p. 187, 188.) This form of encanthis only admits of palliative treatment; unless, indeed, an effort be made to extirpate it entirely, together with the whole of what is contained in the orbit, and even then the event is dubious.

Beer joins Scarpa in the statement, that the operation rarely proves successful, and adds, that it is always followed by an incurable weeping, and a considerable eversion of the lower eyelid. (*Vol. cit.* p. 189.) Fortunately, the truly cancerous encanthis is uncommon: and Mr. Travers, who was a surgeon to the London Eye Infirmary several years, never met with an instance of it. (*Synopsis of Diseases of the Eye*, p. 103.)

The benign encanthis, how large soever it may be, is always curable by extirpation. Those instances which are small, incipient, and granulated, like a mulberry, or of a fringed structure, which originate either from the caruncula lachrymalis, or the semilunar fold of the conjunctiva; or from both these parts together, and even in part from the internal commissure of the eyelids, may be raised by means of a pair of forceps, and cut

off from the whole of their origin, closely to their base, with the curved scissors with convex edges. In the performance of this operation, it is unnecessary to introduce a needle and thread through this little excrescence, as some are wont to do, for the purpose of raising it, and destroying more accurately all its origins and adhesions. The same object is fulfilled by means of forceps, without inconveniencing the patient with a puncture of this kind, and drawing a thread through the part, in order to make a noose. However, in cutting out an encanthis of this small size, care should be taken not to remove, together with that portion of the excrescence which originates from the caruncula lachrymalis, any more of this latter body than what is absolutely necessary for the precise eradication of the disease, in order that no irremediable weeping may be occasioned.

When the little excrescence has been detached from all its roots, says Scarpa, the eye must be washed several times with cold water in order to cleanse it from the blood, and then it is to be covered with a piece of fine linen and a retentive bandage. On the 5th, 6th, or 7th day, the inflammation arising from the operation entirely ceases, and the suppuration from the wound is accompanied with the mucous appearance already described. The little wounds are then to be touched with a piece of alum, scraped to a point like a crayon, and the vitriolic collyrium, containing the mucilage of quince seeds, is to be injected into the affected eye several times a day. If these means should not bring about the wished-for cicatrization; but, on the contrary, the small wounds situated on the caruncula, and internal commissure of the eyelids, should become stationary, and covered with proud flesh, the *argentum nitratum* ought to be applied to them. The conjunctiva, however, should be avoided as much as possible, especially if at all wounded. When the fungous granulations have been destroyed, the cure may be perfected by the collyrium already mentioned, or rather by introducing, thrice a day, between the eyeball and internal angle of the eyelids, the powder of tutty, and the armenian bole. Bidloo extols very much powdered chalk, either alone or in conjunction with burnt alum. (*Exercit. Anat. Chir. Decad.* 2.)

Excision is equally applicable to the inveterate encanthis, which is of considerable size, and broken down at its body, or which forms a prominence as large as a nut, or chestnut, with two fleshy appendages extending along the inner surface of one or both eyelids. The application of a ligature to such an excrescence ought never to be regarded as a method of cure; for the large inveterate encanthis never has a sufficiently narrow neck to admit of being tied. On the contrary, when the tumour is voluminous, its roots invariably extend to the caruncula lachrymalis, the semilunar fold, and the conjunctiva covering the eyeball, oftentimes nearly as far as the cornea. In this state,

also, the encanthis has one or two fleshy appendages, which reach along the membranous lining of one or both eyelids. Hence, though the ligature were to produce a separation of the body of the encanthis, one or both the appendages would still remain to be extirpated. This second operation could only be accomplished with the knife. In this disease, there is no foundation for the fear of hemorrhage, to which the advocates for the ligature attach so much importance; for, cases are recorded of considerable inveterate encanthes being removed without the least untoward occurrence from loss of blood. To these, Scarpa observes, he could add a great number of his own, so that no doubt can now be entertained on this point.

Pellier relates a case, in which an encanthis was followed by a dangerous hemorrhage, though it had been cut out by an expert oculist. He enters, however, into no detail concerning the nature of the complaint, nor the way in which the operation was performed; circumstances from which one might deduce the reason of this unusual accident. Indeed, the same author adds, "I have often performed this operation for such excrescences, and have never met with a similar occurrence." (*Recueil d'Observ. sur les Maladies de l'Œil, Part 2. Obs. 118.*)

When the encanthis is large and inveterate, with two extensive fleshy elongations, one on the inside of the upper eyelid, and the other on that of the lower one, we are to proceed in the following manner. The patient being seated, an assistant is to turn out the inside of the upper eyelid, so as to make one of the appendages of the encanthis project outward. By means of a small bistoury, a deep incision is next to be made into the elongation, in the direction of the margin of the eyelid; and then having taken hold of and drawn it forwards with a pair of forceps, we are to separate it throughout its whole length, from the inside of the upper eyelid, proceeding from the external towards the internal angle of the eye, as far as the body or middle of the encanthis. We are then to do the same to the lippomatous appendage on the inside of the lower eyelid. Afterward the body of the encanthis is to be elevated, if possible, with a pair of forceps; but when this instrument will not answer the purpose, a double hook must be employed. This middle portion is now to be detached, partly by the bistoury and partly by the curved scissors, from the subjacent conjunctiva, on the globe of the eye, from the semilunar fold, and from the caruncula lachrymalis; dividing the substance of this last part more or less deeply, according to the depth and hardness of the large inveterate encanthis. Here it is proper to state distinctly, that when we have to deal with an old, large tumour of this nature, deeply rooted in the caruncula lachrymalis, it is not regularly in our power to preserve a sufficient quantity of the substance of this part, to prevent the tears from dropping over the cheek after the wound is healed.

The eye is to be repeatedly washed with cold water.

The rest of the treatment, consequent to the extirpation of a large encanthis, is almost the same as what was explained in speaking of the small incipient case. Bathing the eye very frequently in the lotion of mallows, and employing anodyne, detergent collyria, are the best local means, until the mucous appearance, preceding suppuration, has taken place on the surface of the wound. Then we may have recourse to mild astringent ointments and collyria. The mildest topical applications are generally the best, both in the first stage of suppuration, as well as afterward, particularly when, together with the encanthis, we have removed a considerable piece of the conjunctiva, which covered the eyeball towards the nose, and was intimately connected with the body of the excrescence.

Consult Scarpa sulle *Mallattie degli Occhi*. Ed. 5, Cap. 12; Richter, *Anfangsgr. der Wundarzn.* Band 2, p. 473, &c. Edil. 1802. G. J. Beer, *Lehre von den Augenkr.* B. 2, P. 187, 8vo. Wein. 1817. On the whole, I consider Scarpa's observations the most correct and valuable, and they have therefore been freely employed in the foregoing article.

ENCEPHALOCLE. (from *εγκεφαλον*, the brain, and *κλην*, a tumour.) A hernia of the brain. (See *Hernia Cerebri*.)

ENCYSTED TUMOURS. (See *Tumours Encysted*.)

ENEMA. (from *ενιεναι*, to inject.) A clyster.

The following are some of the most useful clysters employed in the practice of surgery.

Cathartic.

- R. Decocti Hordei ℥j.
Sodæ Murialis ℥j.—Misce.
- R. Decocti Avenæ ℥j.
Olei Olivæ ℥ij.
Magnesiæ Sulphatis ℥j.—Misce.

Anodyne.

- R. Mucilaginis Amyli, Aquæ distillatæ sing. ℥ij. Tincturæ Opii guttas xl.
—Misce.
- R. Olei Olivæ ℥iv. Tincturæ Opii guttas xl.—Misce.

The two latter clysters are particularly useful in cases in which there is great irritation about the rectum, bladder, or urethra. They have great effect in diminishing spasmodic affections of this canal and the neck of the bladder.

Tobacco.

Employed in cases of strangulated Hernia.

R. Nicotianæ ℥j. Aq. ferventis ℥j. The plant is to be macerated ten minutes, and the liquor then strained for use. One half should be first injected, and soon afterward the other, unless the clyster should operate with dangerous violence, as it sometimes does in particular constitutions.

ENTEROCELE. (from *εντερον*, the bowels, and *κλην*, a tumour.) A hernia, in which the contents of the tumour are intestine.

ENTERO-EPIFLOCELE. (from *επιπλοα*, the bowels, *επιπλοα*, the omentum, and *κλυσ*, a tumour.) A hernia, in which the contents of the swelling are both intestine and omentum.

ENTROPIUM. (from *εν* and *τροπη*, to turn.) An inversion of the eyelids. (See *Trichiasis*.)

EPIGLOTTIS SHOT AWAY. The practice of Baron Larrey furnishes a curious example, in which the epiglottis of a French soldier was shot off at the battle of Alexandria, on the 21st of March, 1801. The ball entered at the angle of the jaw, crossed the throat obliquely, and came out at the opposite side of the neck. The base of the tongue was grazed, and the epiglottis shot away; the patient spit it up after the accident, and showed it to the surgeon, who first saw him. One may be convinced of the fact by an account of the symptoms.

The patient was not in much pain; but his voice was hoarse, feeble, and scarcely audible.

When he first attempted to swallow, he was seized with a convulsive suffocating cough, attended with vomiting. Annoyed by thirst, which the extreme heat of the weather and the irritation of the wound excited, he incessantly repeated his attempts to drink; but always with the same result. Four days were passed in this deplorable condition. He already experienced violent complaints at his stomach; continual loss of sleep; he had a small accelerated pulse, and was beginning to look thin.

Such was the state of this wounded soldier, when Larrey saw him on the fifth day. After making a few inquiries about what had passed after the accident, attempting to make the patient drink, and examining the interior of the mouth, Larrey was convinced, that the paroxysms of suffocation, and the inability to swallow depended upon the permanent opening of the glottis, the lid of which had been shot away. The prognosis of the injury was exceedingly unfavourable, and there can be no doubt, that, if the patient had been abandoned to the resources of nature, he would have died in the course of a few days. The indications were equally difficult to fulfil: the most urgent was to appease the hunger and thirst, with which this poor soldier was afflicted. Larrey fortunately, was provided with an elastic gum tube, constructed for the œsophagus. This instrument was introduced with the usual precautions, into the pharynx, and by means of it, the patient was given some drink, which relieved him much, and afterward some rich broth. The patient was fased in this manner for six weeks, at the end of which time, he was able, without the assistance of the tube, to swallow thick panado, and thickened rice, made into little balls. The powers of speech and deglutition in time became much more perfect; in consequence, as Larrey imagines, of an enlargement of the arytenoid cartilages, and an expansion of that part of the base of the tongue which lies next to the glottis,

having formed a sort of substitute for the epiglottis. (*Mémoires de Chirurgie Militaire*, T. 2, p. 146—149.)

The foregoing case illustrates, in a convincing manner, the importance and utility of elastic gum tubes for conveying nourishment and medicines down the œsophagus in wounds about the throat. All practitioners, and, especially, military surgeons, should be duly impressed with the necessity of having such an instrument always at hand. The patient, whose case is above recited, owed his preservation altogether to this means, without which he must have been starved to death.

In the fourth vol. of the above work, P. 247, is recorded another case, in which a gun-shot wound, that took away the epiglottis, and broke the *os hyoides*, was successfully treated.

EPIPHORA. (from *επιρροα*, to carry with force.) By this term is meant an accumulation of tears on the anterior part of the eye; in consequence of which, the person afflicted is not only under the necessity of frequently wiping them away, but vision is injured by the morbid refraction, which they produce of the rays of light that enter the pupil. *Stillicidium lachrymarum* is distinguished by modern writers from epiphora: the cause of stillicidium lies in some obstacle to the absorption and conveyance of the tears from the lacus lachrymarum into the sac. Epiphora, on the other hand, consists in a superabundant secretion of tears, and is a disease of the secreting, not of the excreting parts, of the lachrymal organs. (See *W. M. Kenzie's Valuable Essay on the Diseases of the Lachrymal Organs*, p. 47, 8vo. Lond. 1819, and *Beer Lehre von den Augenkr.* B. 2.)

EPIFLOCELE. (from *επιπλοα*, the omentum, and *κλυσ*, a tumour.) A hernia, formed by a protrusion of the omentum. (See *Hernia*.)

EPULIS. (from *επι*, upon, and *ελα*, the gums.) A small tubercle on the gums. It is said sometimes to become cancerous. The best plan of cure is to extirpate it with a knife.

ERETHISMUS. (from *ερεθισμα*, to irritate.) The state of irritation, attending the early stage of acute diseases. Mr. Pearson has described a state of the constitution, produced by mercury acting on it as a poison. He calls it the *mercurial erethismus*, and mentions, that it is characterized by great depression of strength, anxiety about the præcordia, irregular action of the heart, frequent sighing, trembling, a small, quick, sometimes intermitting pulse, occasional vomiting, a pale contracted countenance, a sense of coldness; but the tongue is seldom furred, nor are the vital and natural functions much disturbed. In this state, any sudden exertion will sometimes prove fatal. Mr. Pearson advises, with a view of preventing the dangerous tendency of this affection, the immediate discontinuance of the use of mercury; and exposing the patient to a dry, cool air. The incipient

erethismus may often be averted by the camphor mixture with large doses of the volatile alkali, if mercury be also left off. Sarsaparilla is also beneficial, when the stomach will bear it. (*Pear on Lues Venera*, page 156, &c. Edit. 2.)

ERYSIPELAS. (from *ἐρύω*, to draw, and *πύρρα*, adjoining.) St. Anthony's fire; so called, from its tendency to draw the neighbouring parts into the same state, or, in other words, from its propensity to spread.

Erysipelas may be defined to be an inflammatory, cutaneous, and trivially elevated swelling, attended with a redness, which disappears, and leaves a white spot for a short time after being touched with the end of the finger, and the affection, which is not like phlegmon regularly circumscribed, is characterized by a remarkable propensity to spread.

The part is generally of a bright red colour, clear, and shining. The tumour is not accompanied by throbbing, and a burning heat and tingling are felt, rather than acute pain. In many instances, vesications arise; a circumstance, which led Dr. Willan to include the disease in the order *Bulla*. However, if we mean this arrangement to extend to what is named *local*, or *accidental erysipelas*, as well as to the *idiopathic* forms of the disorder, there cannot be a doubt of its inaccuracy, many examples of erysipelas from local irritation being characterized neither by fever, nor vesications.

The Greeks, admitting into their theories of medicine the metaphysical principles of philosophy, and the superstitious ideas of the Pythagoreans, respecting numbers, agreed in the existence of four elements, four radical qualities, four temperaments, and consequently four humours and four species of tumours, produced by stagnation, or a diseased alteration of the humours above mentioned.

Phlegmon, according to their theory, was formed by the blood, erysipelas by the bilious, œdema by the pituitous, and scirrhus by the melancholic or atrabillious temperament. But as this theory was often contradicted by observation, they were obliged to have recourse to the supposition of a mixture of the humours, by means of which tumours of a mixed description were formed; whence, no doubt, we derive the distinction of simple or true erysipelas, (produced merely by extravasation and deposit of the bilious humour, under the skin;) from the compound or spurious, which took its name from the humour at the time most prevalent; hence the names of phlegmonous, œdematous, scirrhus, erysipelas, &c.

In order to have just ideas respecting the various forms of erysipelas, the first thing is to establish an eligible classification of them. Desault prefers the division of erysipelas into *phlegmonous*, *bilious*, and *local*; (*Chir. Journ.* Vol. 2.) an arrangement which seems founded on experience and correct observation. Mr. Pearson also divides the complaint into three forms, viz. the *phlegmonous*, the *œdematous*, and *gangrenous*; (*Prin-*

ciples of Surgery, Chap. x.) Burserius notices, 1. The *idiopathic*, or *primitive* erysipelas, or that which arises spontaneously from an internal cause, unpreceded by any other disease. 2. *Symptomatic*, or *secondary* erysipelas, depending on another affection, by which its progress is completely influenced. 3. *Accidental* erysipelas, or that which is casually excited by some external manifest cause. (*Instit. Méd. Præ. T. 2. C. 2. 8vo. Lips. 1798.*)

In the *bilious* erysipelas, which would be classed, as an *idiopathic* case, the swelling is trifling, and often imperceptible, the skin of a rose-colour, generally a little verging towards yellow. The sensation, which the patient experiences is neither that of tension nor pulsation, but a painful smarting, similar to what results from the application of hot water, or from exposure to the burning rays of the sun.

Towards the period of the invasion of this disease, and often several days previously, the appetite is lost, the mouth bitter, the tongue moist, and covered with a yellow mucus. Nausea and sometimes bilious vomitings come on. The patient becomes weak and dejected, and is affected with wandering pains and considerable heat, without any particular dryness of the skin or violent sense of thirst. Sometimes the disease begins with fever, more or less violent, preceded by shivering and violent pain in the head.

In the *phlegmonous erysipelas*, the skin is more raised than in the preceding species, the swelling harder and deeper, and of a darker colour. There is generally a slight degree of tension of the integuments, with pungent pain, and occasionally a sensation of throbbing. On the first days of the attack, there is neither bitterness in the mouth, nor nausea, the skin and tongue become dry, and are accompanied with a violent sense of thirst; the pulse is full and hard, indicating plethora. This form of erysipelas most frequently occurs in the face, usually affecting only one side of it; sometimes it seizes one of the extremities; and, in both cases, it is ushered in by a smart feverish attack. (*Bateman, Synopsis of Cutaneous Diseases*, P. 126, Ed. 3.)

At the expiration of a few days, particularly when the disease has been treated by bleeding and an antiphlogistic regimen, the tongue becomes foul and moist at its edges, bitterness of the mouth and nausea supervene, and the disease, in its progress, presents little difference from bilious erysipelas. (*Parisian Chirurgical Journal*, Vol. 2, p. 24, &c.)

The following is a description of phlegmonous erysipelas, as it sometimes appears when it attacks the head.

The attack is mostly preceded by shiverings, complaints about the region of the heart, and other symptoms very similar to those which indicate the approach of an intermittent fever. The heat is often accompanied with a little delirium, and almost always with drowsiness of a more or less

evident kind. The swelling generally makes its appearance on the second night, or third day of the fever, attacking the forehead, the cheeks, the nose, or eyelids. This swelling is elastic and smooth; but it is not distinctly circumscribed, and it gradually spreads over such parts of the face as were not at first affected. The skin becomes of a bright red colour; occasionally having a tendency to a livid hue; in other instances having a mixture of yellow. These colours disappear when pressure is made on the part affected, but very soon reappear when such pressure is discontinued. The patient experiences a burning heat, and a disagreeable pricking in the part, rather than any acute pain; sometimes he complains of a very troublesome itching. The surface of the tumour is shining, and, as it were, semi-transparent; but without hardness, tension, or any sensation of throbbing. The eyelids are often so swollen that the patient cannot see, and the whole countenance is exceedingly disfigured. On more or less of the erysipelatous tumour vesications arise on the fourth, or fifth day; they are filled with a transparent serous fluid, and bear a great resemblance to those which are occasioned by boiling water. They commonly burst, or subside on the fifth, or sixth; the fluid, which is discharged, sometimes excoriating the neighbouring parts. Frequently, there is even a slight ulceration at their base, which ulceration, in the worst sort of cases, assumes a gangrenous appearance, and falls rapidly into a state of complete mortification. When the disease takes a more favourable course, the fever now begins to abate; the vesications dry up; and, at the end of eight or twelve days, the cuticle peels off, and the scabs, situated in places which were occupied by the vesications, fall off. The degree of danger depends materially on the delirium and other symptoms indicating an affection of the brain. When phlegmonous erysipelas attacks the face, the termination of the disorder in suppuration is very rare. (*Bateman, Vol. cit. p. 127.*)

According to several writers, the seat of erysipelas in the greater number of cases is the very surface of the cutis; its most vascular and nervous part. (*Dict. des Sciences Méd. T. 13, p. 255.*) And, perhaps, it may be true, that the disorder here commences, and is most intense. Yet, there can be no doubt, that the affection generally extends more deeply, and affects the subjacent cellular membrane, particularly in cases of phlegmonous erysipelas. The affection of the cellular membrane, however, is very different from what happens in phlegmonous inflammation. In true erysipelas, healthy pus is rarely found enclosed in a circumscribed cavity; and when there is any secretion of purulent matter, a feel is communicated, on compressing the part, almost like that which a sponge would give. In such cases, the cellular substance is frequently gangrenous.

It does not appear to me, that any very exact information has yet been established

respecting the causes of erysipelas. We absolutely know nothing about the *immediate* cause; the prevailing ideas concerning the *predisposing* causes are vague; and only those causes, termed *exciting*, appear entitled to much confidence. They are:

1. Violent passions, such as anger, acute grief, &c.
2. Exposure to the heat of the sun, or that of the fire, too long continued.
3. The impression of cold damp air.
4. The action of various vegetable, mineral, and animal poisons.
5. Wounds, contusions, fractures, the stings of insects, &c.

In most cases, erysipelas would seem to be intimately dependent on the state of the constitution. Thus, persons in the habit of drunkenness, and other kinds of intemperance, and who, in a state of intoxication, meet with local injuries, often have erysipelatous inflammation in consequence of them. Other subjects, who lead more regular lives, experience, when they meet with similar injuries, healthy phlegmonous inflammation.

The opinion of Hippocrates and Galen, with respect to the origin of this disorder from a congestion of the bile, is universally known to all initiated in the profession of Surgery. This old doctrine has been, in some measure, revived by Tissot, and many other believers in the humoral pathology, who attribute the cause of erysipelas to an acrid humour, commonly a bilious one, diffused through the mass of the blood. But, much as I despise the absurdity of this theory, observation obliges me to confess, that the complaint seems frequently to be connected with a wrong state of the chylipoietic viscera, and especially of the liver.

A further proof, that erysipelas is mostly dependent on constitutional causes, is, that the affection most frequently happens in autumn, or in any season, when hot weather is succeeded by cold and wet.

Erysipelas frequently attacks both sexes; but women are thought to be rather more subject to it than men, and the reason for this circumstance, generally mentioned, is the greater delicacy and tenderness of the skin in females. But, it would be quite as rational to suspect their weaker and more irritable constitutions, and their sedentary mode of life. In lying-in hospitals, and other charities for the reception of children, new-born infants are often afflicted with a species of erysipelas, which begins in the umbilical region, and thence extends to the pudenda. This case, which sometimes terminates in gangrene, and proves fatal, has been ascribed by some writers to injury done to the navel-string during labour, and by others to the bad air frequently allowed to accumulate in establishments of the above description; a cause, which too often renders complaints, which are at first trivial, ultimately fatal.

Sometimes, the complaint is scarcely cured in one place, when it makes its appearance in another; and when this tendency is evinced in a great degree, the case is termed

erysipelas ambulans, vel erraticum. La Motte has published a striking instance of this form of the disease. A child, between nine and ten years of age, was attacked with erysipelas of the scalp, forehead, and ears, which afterward extended to the neck, and then to the shoulders, while the scalp and face became free from it: in proportion as the disease spread downwards, all the upper parts got well, so that, in the end, there was no portion of the surface of the body, which had escaped, even down to the fingers and toes, the parts last of all affected. (*Obs. Chir.*)

A very uncommon variety of disease is an *universal erysipelas*. No disorder is more subject, than the present, to relapses; but a remarkable thing, sometimes attending the return of the complaint, is its being sometimes strictly *periodical*. In chlorotic women, the erysipelalous attack is occasionally made every month just at the period when the menses should take place. (*Hoffman.*) This periodical nature of erysipelas has been observed in men: Lorry knew two male patients, one of whom used to be attacked with erysipelas twice a year at the time of the equinox; the other had only one attack annually, which was wont to happen in the beginning of the spring. My friend, Mr. Maul of Southampton, lately informed me of an erysipelas, which was both periodical and universal, affecting a lady several times, at intervals of two years.

A doctrine has been started, that erysipelas is sometimes propagated by contagion. (*Wells, in Trans. for the Improvement of Med. and Surg. Knowledge, Vol. 2, Art. 17, 1800.*) But, as Dr. Bateman has truly remarked, such cases, are, at all events, extremely rare, and perhaps never happen in well-ventilated and cleanly houses. (*Synopsis, &c. p. 131.*) In places of an opposite description, the infection of many individuals together might be explained by the operation of the same exciting causes upon them all, without any supposition of contagion.

The characters which distinguish erysipelas from phlegmon are:

1. The inflammatory swelling, which takes place in the former, is not so elevated as in the latter, and is never plainly circumscribed.
2. In most cases, the surface of the skin seems as if it were burnt.
3. The redness, though of a bright description, disappears on pressure.
4. The sense of throbbing, and darting pain, attendant on phlegmon, is not observable.
5. The inflamed part is free from tension, and appears as if it were affected with œdema, or rather with emphysema; only one can perceive no crepitation.

It must not be inferred from these differences, that erysipelas is to be considered as a disease essentially distinct from those, which are called inflammatory, as it has some characters in which it manifestly approaches them. Like phlegmonous inflam-

mations, it may be excited by any local irritation. Like other inflammations, it may end in suppuration, though of a less perfect sort, than that in which phlegmon ends, and rarely contained in a circumscribed cavity. The pulse, in phlegmonous erysipelas, is frequent, hard, sometimes full; and when the patients are bled, their blood has the same appearance, and is covered with the same kind of inflammatory crust, as blood taken away in other kinds of inflammation.

It is proper, however, to notice, that practitioners are not universally agreed with respect to the nature of the pulse in erysipelas: it is, according to some, particularly Mr. Pearson, soft, frequent, and often irregular. But, if due attention be paid, this difference will be found to depend on particular circumstances. In the *phlegmonous* erysipelas, the pulse will always be fuller than in the *bilious*. In the impure air of hospitals, and in all places, where the air is impregnated with carbonic acid gas, and other noxious gases, we find, that various affections decidedly inflammatory, especially those which are attendant on wounds, affect the body, and the sanguiferous system in particular, in a very different manner from what is observed when the patients are living in a more salubrious air. All inflammations assume a character more or less unfavourable, in consequence of the influence of bad air. This is particularly striking in cases of erysipelas. In such instances, living in an impure atmosphere has a singular effect in augmenting the sense of weakness and dejection, which patients always experience in a certain degree; and, in these cases, it may even go so far as to produce a total alteration of the state of the pulse. But, if attention be paid to the disease in a situation where the atmosphere is not impregnated with putrid effluvia, it will be found to put on a very different shape. The symptoms of dejection, of nervous irritation, and of cerebral disturbance, are much less conspicuous, and the state of the pulse, especially in patients who have not been previously debilitated by other diseases, bears a great resemblance to that which takes place in an inflammation of the chest.

Besides bad air, many other circumstances, which do not even belong to the nature of erysipelas, may have a share in producing an alteration of its symptoms. Thus, while inflammations of another kind, such as pleurisy and acute rheumatism, particularly affect robust persons, in whom the vital principle exists with a great deal of energy, erysipelas is prone to attack persons who are aged, or of delicate and depraved constitutions. The latter is also seen making its appearance as a symptom, in weakened parts, which have in a certain degree been deprived of their tone, as is the case with œdematous parts. It is not surprising, that, in these different cases, in which the tone of the system has already suffered, the state of the pulse, in persons affected with erysi-

nelas, should seem different from what it is in individuals, who are more healthy and robust.

Treatment of Erysipelas.

The treatment of *idiopathic* erysipelas varies according to the causes, symptoms, complications, and anomalies of the disease, and may be divided into *internal* and *external*. That the mode of relief must be very different in *phlegmonous* erysipelas from what it is in other varieties of the disorder, must be plain to every body, who has the least knowledge of the nature of diseases in general.

Common cases of *acute*, or *phlegmonous* erysipelas, yield to mild purgatives, and a light vegetable diet, with which remedies practitioners usually conjoin diaphoretics and the saline mixture. Whether bleeding is right or not in this species of erysipelas, is a point, on which different sentiments prevail. I believe, however, that venesection in the milder forms of the complaint is now pretty generally allowed to be unnecessary, nor is it necessary to repeat bleeding in any case of erysipelas so frequently as is done in other inflammatory diseases. We ought to be guided, however, in this respect, by the state of the pulse, and other symptoms, never forgetting the patient's age, strength, and other important considerations. *Cæteris paribus*, the patient will bear bleeding better in the country, and in an open, pure air, than in a large city, and especially in an hospital. And, as has been truly remarked, unless there be a considerable tendency to delirium, or coma, blood-letting can seldom be repeated with advantage, at least in large towns. (*Pearson's Principles of Surgery; Bateman's Synopsis*, p. 132, Ed. 3.) Instead of this practice the latter author judiciously recommends local bleeding and blistering, *but not upon, or very near the diseased surface*, whereby he avoids producing the troublesome sores, the frequency of which in former times, after taking blood from erysipelatous parts, led Mr. B. Bell to pronounce a general condemnation of the method. Alexander of Tralles, and Paré had a high opinion of the beneficial effects of plenty of fresh, cool air in cases of erysipelas, and the truth of this sentiment is acknowledged by all the best physicians and surgeons of the present day. Care should be taken also, that the patient be not covered with too much clothing; a piece of advice delivered by the first of the two preceding writers.

Cullen, whose theories induced him to regard erysipelas as a species of putrid fever, combined with evacuants the use of bark, wine, and other antiseptics. But, as Dr. Bateman correctly observes, the administration of cinchona and opium, in cases of *acute* or *phlegmonous* erysipelas, is certainly unnecessary, and appears to be of equivocal safety.

In the *bilious* erysipelas, whatever degree of heat or fever might exist, Desault gave, in the first instance, a grain of tartarized antimony dissolved in a considerable quantity of fluid; and the symptoms generally

diminished as soon as the effects of the medicine had ceased. He had seen them entirely subside, although the medicine produced no other sensible alteration, in the animal economy, than an increase of the insensible perspiration and urine: sometimes the symptoms resisted these evacuations, and he was obliged to have recourse once or twice, or even more frequently, to the use of the emetic drink. When the erysipelas was cured, and the bitterness in the mouth and fever had subsided, two or three purges of cassia and manna, with a grain of emetic-tartar, were exhibited; during the cure, the patient was ordered to drink freely of a diluting ptisan, acidulated with oxymel: and as soon as the symptoms were mitigated, the diet of the patient was allowed to be more nourishing and generous; for, when it was too spare, the case was remarked never to proceed so favourably, particularly in hospitals, where the air, generally speaking, is unhealthy. In the bilious erysipelas, Desault observed, that the cases of the patients, who had been bled previously to their admission into the hospital, were invariably the most serious and obstinate, particularly, when the bleeding had been frequently repeated.

In cases of bilious erysipelas, many modern practitioners would be bolder with antimonials than Desault, first, by imitating Richter, and giving an emetic at the commencement of the attack, and then by exhibiting more freely either antimonial powder, or tartarized antimony, with a dose or two of calomel.

In *phlegmonous* erysipelas, Desault was an advocate for bleeding in the beginning of the disorder, and, this practice he followed up by the administration of tartarized antimony and evacuants.

In cases of *idiopathic* erysipelas, whether *phlegmonous* or *bilious*, external applications have been deemed useless, or hurtful, by a large proportion of practitioners, among whom is Desault. In the early stage of the disease, Dr. Bateman has found powdery substances, like flour, starch, chalk, &c. increase the heat and irritation, and afterward when the fluid of the vesications oozes out, such substances produce additional irritation, by forming with the concreting fluid hard crusts upon the tender surface. This practice is also condemned by Mr. Pearson. The only plan, perhaps, which is unobjectionable, as a means of allaying the irritation produced by the discharge from the vesication, is that advised by Dr. Willan, and which consists in fomenting, or washing the parts from time to time with milk, bran and water, or a decoction of elder-flowers and poppy-heads. In the early stage of the inflammation, Dr. Bateman has found great relief derived from moderate tepid washing, or the application of the diluted liquor ammon. acet. (*Synopsis of Cutaneous Diseases*, p. 133, Ed. 3.)

Though Desault forbids local remedies in cases of *idiopathic* erysipelas, he does not extend the prohibition to examples, either

of bilious or phlegmonous erysipelas, from a contusion, wound, or an ulcer; regimen and internal medicines, according to Desault, here being insufficient, unless topical applications are employed to abate the local irritation, and excite suppuration. With this view, he commends cataplasms, but he deems one caution essential, viz. that the application of the poultice should not extend much below the contused surface, or the edges of the wound. If any application is permitted on the rest of the erysipelatous surface, he thinks, that it should be the liquor plumbi acetatis dilutis made weak. (*Parisian Chirurg. Journ. Vol. 2.*)

Mr. Pearson prefers mild warm cataplasms, composed of the powders of anniseed, fennel, camomile flowers, &c. mixed with a fourth part, or an equal quantity, of bread, and a proper quantity of milk. Linseed powder, he says, may sometimes prove a convenient addition.

Little more need be said, respecting the treatment of *secondary*, or *symptomatic* erysipelas. Generally less important than the other disease, with which it is associated, its management is quite subordinate to that of the latter affection. Thus, when erysipelas makes its appearance round a wound, or ulcer, the practice only requires to be somewhat modified according to the circumstances, state, and nature of the injury, or sore.

As for what is termed *accidental* erysipelas, or that caused by casual local irritation, applied directly to the skin, as from acrid substances, heat, friction, the sting of insects, &c. the removal of the cause, the employment of cold, or even ice-cold lotions, and other antiphlogistic means, are the only measures essentially necessary.

Cases of universal erysipelas have been successfully treated by warm-bathing, aperient medicines, and small doses of the acetate of potassa. (*Dict. des Sciences Med. T. 13, p. 266.*)

In the *oedematous* erysipelas, perhaps, bleeding is never admissible. The loss of even a very small quantity of blood may have the most fatal consequences. One should also be exceedingly sparing of other evacuations. A determination to the skin should in particular be kept up by antimonials, and irritation and pain soothed by administering the æther sulphuricus, camphor, opium, &c. When the disorder seems to shift its situation to any internal part, and particularly to the brain, blisters should be applied between the shoulders, to the head or legs, without the least delay. And, it is in the oedematous erysipelas more especially, that the patient's strength should be supported by tonic remedies, wine, bark, and cordials.

In cases of *phlegmonous* erysipelas, if the inflammation continues in an unabated form beyond the seventh, or eighth day, suppuration is to be apprehended. Here Boyer recommends the employment of emollient applications, and immediately a fluctuation is distinguishable (or even what he terms

"*un empatement purulent*") he advises the surgeon to make such incisions as may be necessary for the discharge of the matter. He also states, that the incisions should be made at several depending points. (See *Boyer's Traité des Maladies Chirurgicales, T. 2, p. 22.*) It appears from the observations of Mr. A. C. Hutchison, late surgeon to the Naval Hospital at Deal, that seafaring men are very liable to phlegmonous erysipelas of the extremities, particularly of the legs. The cause is ascribed to the irritation of the salt water, and the friction of their loose coarse trowsers. In this description of patients, the disease frequently proceeds rapidly to the gangrenous state, and the consequence is the loss of many lives and limbs. Even when the danger of mortification is avoided, abscesses often occur, which spread between the muscles and under the integuments to a surprising extent: "from the ankle to the trochanter, and over the glutei muscles." In the first few cases, which came under the care of Mr. Hutchison, this gentleman's plan of treatment, in addition to the usual medical means, consisted of *local bleeding by means of cupping glasses*, followed by fomentations. Subsequently, however, he adopted the method of making several free incisions with a scalpel on the inflamed surface, in a longitudinal direction, through the integuments, and down to the muscles, as early in the disease as possible, and before any secretions have taken place. These incisions may be about an inch and a half in length, two or three inches apart, and vary in number from six to eighteen, according to the extent of surface which the disease is found to occupy. Mr. Hutchison states, that these incisions will yield between fifteen and twenty ounces of blood, and give relief to the tense skin, at the same time that they form channels for the escape of fluid, and the prevention of bags of matter. After the operation, fomentations, or saturnine lotions, are employed.

By the preceding kind of treatment Mr. Hutchison thinks the fatal termination of the disease may be rendered less frequent, and gangrenous mischief wholly prevented. He supports this assertion with observing, that he never lost a case in the Deal Hospital for the last five years, during which the practice was followed. (See *Med. Chir. Trans. Vol. 5, p. 278, &c.*)

On the proposal of this new treatment, I shall make very little comment, because I have never seen it tried. But, I shall venture to state, that I have not much opinion of it. What? are all the principles of surgery now so changed, and is the nature of the human body and constitution so altered, that inflamed parts are to be soothed by maiming and wounding them, or to use the author's words, by making "from six to eighteen incisions" in them? I would beg leave to ask, whether from six to eighteen deep cuts down to the muscles could ever be made in an uninfamed part, without producing inflammation? It is to be remarked, however, that formerly Mr. Hutchison, be-

fore his adoption of this plan, used to apply to the part affected cupping glasses, which every surgeon knows will often of themselves irritate so much by their pressure, independently of the scarifications, as to make the sound skin inflame, and sometimes slough. We must not wonder, therefore, that his early treatment of phlegmonous erysipelas did not answer. As we have mentioned above, on the authority of Boyer and other eminent surgeons, incisions may undoubtedly become necessary in erysipelas, but, not before there is matter to be discharged. When once its existence is ascertained, the employment of the knife cannot too speedily follow.

With regard to the treatment of the gangrenous erysipelas, nothing more need be said than what is contained in the article on mortification.

Consult Desault's *Parisian Chirurgurgical Journal*, Vol. 2. Also *Œuvres Chirurgicales de Desault par Bichat*, T. 2, p. 581, &c. *Encyclopédie Méthodique, Partie Chirurgicale, art. Erysipèle*. Cullen's *First Lines of the Practice of Physic*, Vol. 1. Pearson's *Principles of Surgery*. Some Parts of Hunter's *Treatise on the Blood, Inflammation, &c.* Richerand, *Nosogr. Chir.* T. 1, p. 118, &c. Edit. 2. Lassus, *Pathologie Chir.* T. 1, p. 8, &c. Edit. 1809. *Traité des Maladies Chir.* par M. le Baron Boyer, Tom. 2, p. 6, et seq. A. C. Hutchison in *Med. Chir. Trans.* Vol. 5, p. 278, &c. and *Practical Obs. in Surgery*, 1816. T. Bateman, *A Practical Synopsis of Cutaneous Diseases*, p. 125, &c. Ed. 3. *Dict. des Sciences Méd.* Vol. 13, p. 253, &c.

ERYTHEMA. (from *ερυθρός*, red.) A redness of any part. A mere rash or efflorescence, not accompanied by any swelling, vesication, or fever, circumstances which, according to Dr. Bateman, distinguish it from erysipelas. (*Synopsis of Cutaneous Diseases*, p. 119, Ed. 3.) Its six varieties are described in the latter work. For the erythema mercuriale, see *Mercury*. The term is often wrongly applied to eruptions, attended with redness, and distinct papular and vesicular elevation, as we see in the instance of mercurial erythema, which Dr. Bateman says should be named *eczema*.

ESCHAR. (from *εσχαλα*, to form a scab, or crust.) This term is applied to a dry crust, formed by a portion of the solids deprived of life. When any living part has been burnt by the actual, or potential caustery, all that has been submitted to the action of this application, loses its sensibility and vital principle, becomes hard, rough on the surface, and of a black, or gray colour, forming what is properly named an *eschar*, a slough, produced by caustics, or actual fire.

ESCHAROTICS. (from *εσχαλα*, to form a crust over.) Applications, which form an eschar, or deaden the surface on which they are put. By escharotics, however, surgeons commonly understand the milder kinds of caustics, such as the *hydrargyri nitrico-oxidum*, *subacetate of copper*, &c.

EXARESIS. (from *εξαίρειν*, to remove.) One of the divisions of surgery adopted by

the old surgeons; the term implies the removal of parts.

EXCORIATION. (from *excorio*, to take off the skin.) A separation of the cuticle; a soreness, merely affecting the surface of the skin.

EXFOLIATION. (from *exfolio*, to cast the leaf.) The separation of a dead piece of bone from the living, is termed *exfoliation*.

One part of a bone is never separated from another by the rotting of the dead part, for that which comes away is as firm as it ever was. Exfoliation takes place with most expedition in bones, which have the fewest cells, and whose texture is the closest. Before any part of a bone can be thrown off by exfoliation, it must be dead. But, even then till the process of exfoliation begins, the bone adheres as strongly as ever, and would remain for years, before it could be separated by putrefaction alone. The human bones are composed of two substances, viz. a true animal matter, and an earthy one, the phosphat of lime, which are only mixed with each other. A dead bone acts on the system, in the same manner, as any other extraneous body. It stimulates the adjacent living parts, in consequence of which, such a process is begun, as must terminate in its being thrown off. The effects of this stimulus are, first, that the living adjacent bone becomes more vascular; a circumstance, which always takes place, when a part has more to do, than is just sufficient for the support of life. Secondly, that the earth of the living part, where it is in contact with the dead bone, is absorbed; and there the bone becomes softer, and adheres by its animal matter only. As Mr. Wilson has stated, "before any mark of separation is seen on the surface, the living bone surrounding the dead, for the extent of a mere line, has become as soft as if it had been steeped in acid." (*On the Skeleton and Diseases of the Bones*, p. 281, 8vo. London, 1820.) Thirdly, that the living animal part is at last absorbed along the surface of contact: this part of the process commences, however, long before the last is finished; and both of them begin at the surface; though, in their course, they do not every where take place in an equal degree at the same time. Fourthly, in proportion to the waste made by the last part of the process, granulations arise from the living surface, and fill up the intermediate space, so that there is no vacuum. These different stages together constitute ulceration. When any part of a bone is once loose, it is pushed to the surface in the same manner, as most other inanimate bodies would be, and this stage is partly mechanical, and partly a continuation of ulceration. A proof of the third stage, above mentioned, may be derived from cases, in which people die, while exfoliation is going on. A small groove, or worm-eaten canal, can then be discovered, which becomes gradually deeper, and follows the irregularities of the living and dead surfaces. After the application of the tre-

pan, a circular piece of bone is frequently thrown off, which is always less than the space from which it came. This, as Mr. Hunter observed, would never be the case were there not a loss of substance.

"Although (says Mr. Wilson) in general the absorption takes place in the living bone, it still appears, that, under peculiar circumstances, the absorbing vessels have the power of acting on and removing the substance of dead bone. This happens after the dead part has been separated from the living, and when from its shape, and the form of the living surrounding bone, it is prevented from obtaining a passage to the surface of the body; as in exfoliations of the cranium, when the inner table of the exfoliated part is broader and wider than the outer table." (*On the Skeleton, &c.* p. 282.) In very hard bones, the colour of the dead, exfoliating portion is generally white; but, in softer bones, it is yellow, dark, and sometimes black. (*Wilson, op. cit.*)

It was anciently believed, that whenever a bone was denuded, the exposed surface must necessarily exfoliate, and, this being taken for granted, the old surgeons used to put immediately in practice whatever they thought best calculated to bring on an exfoliation as quickly as possible. For this purpose, the actual cautery was usually applied to the part of the bone which was uncovered, and as, under such treatment, a portion of the bone was of course killed, and then exfoliated, the prejudiced practitioner believed, that he had only accelerated a process which must of necessity have followed in a more slow and tedious manner.

According to Mr. Hunter, neither caustics nor the actual cautery hasten exfoliation; they only produce death in a part of the bone, which is the first step towards exfoliation, and if they ever hasten exfoliation, when the bone is already dead, it must be by producing inflammation in the adjacent living bone; a change that makes it exert a power of which it was previously incapable.

Exfoliation is not a necessary consequence of a bone being laid bare, and deprived of its periosteum. If the bone be in other respects uninjured, healthy, and enjoying a vigorous circulation of blood through its texture, granulations will be generated on the surface of such bone, which will cover and firmly adhere to it, without the smallest exfoliation being thrown off, especially in young subjects. But if caustic, stimulating, or drying applications be made use of, or the bone be left for a considerable time exposed, the circulation in the superficial portion of it will necessarily be disturbed and destroyed, and that part of the surface, through which the circulation ceases to be carried on, will be separated and cast off by the process of exfoliation.

If any application to an exfoliating portion of bone be at all efficacious, it must be one which will stop the mortification in the affected bone, and promote the absorption of those particles of phosphate of lime, which form the connexion between that

which is living and that which is actually dead. And as the bone dies from the same causes as the soft parts mortify, we should at least follow in practice the same principles which we adopt in the latter instance; and though, from the inferior vascularity, and vital power of bones, we cannot expect surgery to have as much control over their affections as over those of the soft parts, yet every good will thus be obtained which it is possible to acquire. Attention to such principles will at least teach us to refrain from making the death of part of a bone more extensive than it would be, if the cautery, caustics, and strong astringents, were not employed.

The best mode of attempting to prevent an exfoliation from occurring at all in a bone that has been exposed by a wound, is to cover the part again, as soon as possible, with the flesh, which has been detached from it. This, as I shall hereafter notice, (*see Head, Injuries of,*) may generally be practised with advantage, when the scalp has been detached from the cranium, provided the flap have still even the most limited connexion with the rest of the integuments.

When the exposed bone cannot be covered, it should be dressed with the mildest and simplest applications, with plain lint, or lint spread with the unguentum cetaceum.

The dead pieces of bone, when very tedious in exfoliating, when wedged in the substance of the surrounding living bone, and when so situated as to admit of being safely sawn, or cut away, may sometimes be advantageously removed in this manner. (*See Caries and Necrosis.*) In such operations, Mr. Hey's saws may be employed with great convenience; and where these are not applicable, that invented by Mr. Machell, and described in Mr. A. Cooper's Surgical Essays, or another devised by Graefe, and explained by Schwalb (*De Serra Orbiculari, 4to. Beral.* 1819,) deserve to be recollected.

In speaking of necrosis, I shall have occasion to notice the efficacy of blisters, kept open with the savin cerate, in quickening the process by which dead portions of bone are loosened, as particularly pointed out by the late Mr. Crowther, in his work on the white swelling.

Tenon published three Memoirs on the Exfoliation of Bones. The two first are inserted at pages 372, and 403, *Mem. de l'Acad. des Sciences*, 1758; the third at p. 223 of the same Work, for 1760. P. Poissonier, *An recenti vulnerè nudatis ossibus exfoliatis? conclusio negans*, 4to. Parisii, 1760. *Journ. de Méd. par M. Roux*, T. 31, p. 801, T. 32, p. 181, T. 33, p. 168, T. 36, p. 537, T. 38, p. 153, T. 39, p. 432. Theden, *Neue Bemerkungen, &c.* Kap. 3, 8vo. Berlin, 1782. *Trans. for the Improvement of Med. and Chir. Knowledge*, Vol. 2, p. 277, &c. Wiedman in his excellent book, entitled "*De Necrosi Ossium*," has given an account of the various opinions of several distinguished writers, concerning the way in which a dead portion of bone is separated from the living part; and he has refu-

ted many erroneous doctrines set up by Hippocrates, Van Swieten, B. Bell, &c. See p. 23, et seq. op. cit. *Dict. des Sciences Méd. art. Exfoliation.* J. Thompson's *Lectures on Inflammation*, p. 394, 398. P. Boulay sur l'Exfoliation des Os, 4to. Paris, 1814. J. Wilson on the Structure and Physiology of the Skeleton, and on the Diseases of the Bones, &c. p. 230, &c. 8vo. Lond. 1820.

EXOMPHALOS. (from ἐξ, out of, and ομφαλος, the navel.) A hernia at or near the navel.

EXOPHTHALMIA. (from ἐξ, out, and οφθαλμος, the eye.)

In the case to which the most judicious surgical writers apply the terms *exophthalmia*, *ophthalmoptosis*, *ptosis bulbi oculi*, the eyeball is of its natural size, and free from disease; it merely changes its situation, and partly or completely protrudes from the orbit. It is only confusing the subject to consider, as specimens of this disease, the cases in which the globe of the eye is affected with enlargement, and on that account projects from the orbit in a preternatural degree, as happens in *hydrophthalmia*, *staphyloma*, and cancerous diseases of the eye. When the globe of the eye is pushed entirely out of the orbit, it generally lies upon the temple, or cheek, and vision is totally destroyed. There are instances, however, in which a considerable degree of sight was recovered, notwithstanding the exophthalmia was complete, and had lasted several years. (*Hope in Phil. Trans. for 1744. Richter's Bibl. 4 Band. p. 343.*)

There are three descriptions of causes which may occasion exophthalmia.

1. The first and least common is a violent concussion of the head. A man fell from a height of about fifteen or sixteen feet, and pitched upon his head. The right eye was forced out of its socket, and hung over the cheek. The patient was deprived of his senses immediately after the accident, and affected with coma. There was a contusion over the right parietal bone, but no fracture. The eye spontaneously resumed its natural position a short time after the accident, and in the course of a month, with the assistance of low diet and repeated bleeding, the cure was completed. (*Mém. de l'Acad. de Chirurgie, Tom. 1, p. 198, 4to.*) It has been alleged, that the eye has been forced out of the orbit in a violent fit of sneezing. But such cases, says Richter, are very uncommon, and always imply a considerable relaxation of those parts, which serve to retain the eye in its socket, or some other predisposing causes, to which attention should be paid in the treatment. (*Richter, Anfangsgr. der Wundarz. B. 3, p. 407, Ed. 1795.*)

2. A far more frequent cause of exophthalmia is a thrust in the eye with an instrument which is narrow enough to pass between the orbit and the eyeball, so as to push the latter out of its place.

A stick, a tobacco pipe, (*White's Cases in Surgery, p. 131.*) a foil, &c. may cause the accident. Repeated experience proves, says Richter, that, in such cases, though the

optic nerve and muscles of the eye may be forcibly stretched, the interior parts of the organ seriously injured, and the dislocated eye generally deprived of the faculty of seeing, yet, when the organ is replaced as speedily as possible, it not only sometimes recovers its natural motion, but also its original power of vision. (See *Scultet. Appendix, Obs. 69. Covillard, Obs. 27. Borellus, Centur. 3, Obs. 54. Rhodius, Centur. 1, Obs. 84. White's Cases, p. 131.*) But before we reduce the eye, Richter advises us always to examine the instrument, which was pushed into the orbit; as, when it is brittle, a fragment of it may remain behind in the socket, and require to be extracted by means of the finger or a probe. When the weapon is pointed and hard, it sometimes pierces the bones of the orbit, and enters the brain, nose, or antrum. In the first case, which is often difficult to ascertain immediately, though after a time it is generally rendered plain enough by the symptoms induced, the consequences are mostly fatal. In the two other cases, although the danger is not pressing, yet the surgeon should be very attentive, in the event of suppuration, to procure and maintain a ready outlet for the matter.

There is generally little difficulty in replacing the eye. Frequently it returns of itself into its natural situation again, as soon as any trivial obstacles to its reduction are removed; and in other instances, it easily admits of being put into its proper place with the hand. The indication, says Richter, is always accomplished with more facility, the sooner it is attempted. When the protrusion has existed several days, and the eye and other parts in the orbit are already inflamed, Richter recommends us to endeavour to diminish the inflammation by general antiphlogistic means, and external emollient applications, before we try to replace the eye, and the reduction of this organ is afterward to be effected in a gradual manner. When the optic nerve, and one or more of the muscles of the eye are torn, no hope can be entertained, that the eyesight and motion of the organ will ever be regained. But this degree of injury, as Richter observes, cannot always be immediately detected, because the optic nerve and muscles are concealed by the conjunctiva; and, if the nature of the case were known, still it would be advisable to replace the eyeball, and endeavour to prevent the disfigurement which its loss would unavoidably produce. But, says Richter, it is necessary, especially if the parts behind the eyeball have suffered severely, to use such means as will ensure a ready escape for the matter which may possibly form. Though Richter offers the opinion, it is difficult to conceive how the violence of the injury of the conjunctiva, muscles, and nerve, can ever render it most prudent not to reduce the part, until after suppuration has taken place. Richter thinks, that a surgeon may the more readily make up his mind to this conduct, as many cases have proved that the eyeball, even after being dislocated from the orbit a long while,

has been easily replaced. In other instances, the parts which connect the eye with the orbit may be so torn and injured, that it will be most advisable to extirpate the organ.

Richter maintains, however, that this should never be done when there is the least chance of saving the eye. If the bones in the orbit be fractured, the reduction must not be made until the indications which this complication presents, have been fulfilled.

When, says Richter, the instrument, with which the eye has been pushed out of its socket, is blunt and thick, like a finger, a stick, a foil, &c. the eyeball itself always sustains a violent contusion, which brings on vehement inflammation, and lessens or destroys all hope, that, after the reduction, the eyesight will be restored. Sometimes, in these cases, an extravasation of blood in the orbit occurs, the iris is lacerated, the cornea burst, and a part of the humours of the eye discharged. Although, under such circumstances, it is scarcely to be expected that the eyesight can be recovered, yet, it is proper to reduce the eye, because, should the organ be destroyed by suppuration, or the loss of its humours, the deformity may be obviated by an artificial eye, which is not the case, when the eye has been cut away. It is also to be considered, that the mischief often seems to be worse than it really is, and the eyesight is sometimes regained contrary to all expectation.

After the reduction of the eye, the first care of the surgeon should be to prevent and diminish inflammation. In some cases, the inflammation is slight; while, in others, especially when the eyeball has been severely struck, it is extremely violent. All the usual antiphlogistic means, both general and topical, are to be employed, and, of the latter, Richter says, astringents are the best, as the inflammation arises from the contusion and stretching, which the parts have suffered. The possible consequences of inflammation, such as suppuration, opacity of the cornea, &c. are to be treated according to the rules laid down in other parts of this dictionary. (See particularly *Cornea*, *Opacity of*; *Hydropium*; *Ophthalmia*.) In general, the sight is restored in proportion as the inflammation is diminished. Should this not happen, after the ophthalmia has been entirely removed, the surgeon must try what effect such remedies, as stimulate the nerves, will have upon the optic nerve. An account of the most eligible medicines, for this purpose, will be found in the article, *Amaurosis*.

3. The third cause of exophthalmia is a preternatural tumour in the orbit, or neighbouring parts. The swelling, as it enlarges, gradually pushes the eyeball out of its socket. The tumours, which may be formed in the orbit, are of several kinds. The principal, however, are encysted swellings, which contain either fat, an aqueous fluid, a pappy substance, or a thick matter. Sometimes, the cellular substance in the orbit is affected with induration and swelling, so as to force

the eye partly or completely out of this cavity.

According to Mr. Travers, adipose swellings occupy the interspace of the recti muscles, emerge between the globe and the orbital circumference, and have an oblong figure. When the conjunctiva is freely divided, the fatty mass is easily drawn forwards with a hook, and dissected out. (*Synopsis of Diseases of the Eye*, p. 225.)

An abscess in the orbit may cause a protrusion of the eyeball. (*Pellier*.) Exostoses in the orbit may have the same effect. In the records of surgery may be found many examples, in which the displacement of the eye was produced by a tumour, that grew out of the frontal sinus: (See *Langenbeck's Neue Bibl. B. 2*, p. 247.) In some cases, in consequence of suppuration in the antrum, the lower part of the orbit is raised, and the eye forced out of its place. Fungous diseases of the antrum are very liable to occasion the same mischief. (See *Parisian Chirurgical Journal*, Vol. 1. p. 104, &c.)

Not long ago, Langenbeck extracted from the sinus frontalis of a girl, a large hydatid, which had forced the outer table considerably forwards, and depressed the orbital process of the os frontis so far, that the eyeball was propelled as low as the extremity of the nose. After the front of the sinus had been perforated, and the hydatid removed, there was a cavity left two inches and a half in depth. (*Neue Bibl. B. 2*, p. 247, *Hanover*, 1819.) My friend Mr. Lawrence some time ago mentioned to me a remarkable case, which presented itself at the London Eye Infirmary: it was an exophthalmia, which arose from a collection of hydatids in the orbit, and was cured by making an incision, and afterward promoting their discharges. In all these examples, the eyeball is displaced from the orbit gradually, and vision is at length impeded. Instances, however, are on record, where the sight was never lost, though the eye was protruded for years. (See *Richter's Chirurg. Bibliothek. 4. Band, 2 Stück*, p. 243, *White's Cases in Surgery*, p. 135.) In an instance lately reported, the sight was not at all lessened, and the iris retained its natural mobility. (*Langenbeck, Neue Bibl. B. 2*, p. 245.)

Experience proves, also, that after the reduction, the motion of the eye, and power of seeing may be regained, in cases where the eye has been gradually pushed out of the orbit, and been displaced a considerable time, even as long as several years, during all which period vision was lost. (*Acrell; Brocklesby in Med. Obs. and Inquiries, Vol. 4*.) Langenbeck relates a very curious case of exophthalmia from a steatoma in the orbit, where, though vision was entirely prevented during the displacement, the pupil was of its regular shape, and the iris capable of motion: after the extirpation of the tumour, the eyesight became so good, that the patient could discern the smallest objects. (*Neue Bibl. B. 2*, p. 240.) In order to reduce the eye into its natural position, it is necessary to remove the cause, by which its pro-

trusion is occasioned. Suppuration and fungous tumours in the antrum must be treated according to directions laid down in the article *Antrum*. After the cure of such diseases, the antrum is often reduced to its natural dimensions, and in this circumstance, the orbit may become so wide, that the eyeball will return into it again. Should this not happen, the extirpation of the organ will be proper. The induration and swelling of the cellular substance in the orbit, may be sometimes dispersed by means of mercury.—(*Louis, sur Plusieurs Maladies du Globe de l'Œil, in Mém. de l'Acad. Royale de Chirurgie, T. 13, Ed. 12mo.*) When such treatment fails, we are recommended to extirpate the eye. (*Richter Anfangsgr. der Wundarzen, B. 3, p. 413.*) Exostoses, situated in the anterior part of the orbit, may sometimes be removed. The continental surgeons generally advise us to expose the tumour by an incision, and to apply caustic, or the actual cautery to it, in order to kill the protuberant part of the bone, and make it exfoliate. In this country, most practitioners would prefer the employment of cutting instruments for removing such exostoses. When, however, the tumour lies deeply in the orbit, it cannot be got at, and if it should resist the effect of mercurial medicines and mezercon, we are directed to extirpate the eye. (*Richter op. et loco cit.*) Abscesses in the orbit ought to be opened, and after this has been done, the eye generally returns into its proper position. (*Pelletier.*) When encysted tumours in the orbit admit of being extirpated in the customary manner, the plan should be adopted; but, when this cannot be done, Richter's advice may be followed, which is to open them, press out the contained matter, and afterward extract the cyst. Considerable difficulty, however, frequently attends every effort to remove the whole cyst, and unless this be done, a permanent cicatrization cannot be expected. (See *Travers's Synopsis, p. 225.*)

On account of the vicinity of the brain, and the communication between the parts within the orbit and the dura mater, the extirpation of tumours from that cavity is not exempt from risk of fatal consequences, as two cases recently published by Langenbeck, fully prove. (*Neue Bibl. B. 2, p. 241—244.*) A young lady was referred to Mr. Lawrence and myself this spring, (1821,) by Mr. Maul of Southampton, for advice, respecting a tumour occupying the inner and upper portion of the orbit, and attended with a degree of exophthalmia, constant exacerbation at the period of the menses, and occasionally double vision. (See *Diplopia*.) We refrained from advising any immediate attempt at extirpation, the swelling being so firm and immovable, that the disease was suspected to be partly of a bony nature. However, on seeing this case about a fortnight afterward, I was surprised to find the tumour not more than half its former size, and all the firm and (what was conceived to be) bony induration below the superciliary

ridge of the os frontis gone, as well as the exophthalmia, and derangement of vision. Some sharp bony irregularities, however, could now be most plainly felt, projecting in front of the diminished swelling.

In a late publication, a memorable case of exophthalmia is related by Mr. Travers: the globe of the eye appears to have been gradually forced upwards and outwards, and to have had its motions considerably impeded, in consequence of the orbit being partly occupied by two swellings, which were of the nature of the aneurism by anastomosis.—(See *Aneurism*.) The swellings could not have been removed, without at the same time extirpating the eye. Mr. Travers was therefore induced to try, whether applying a ligature to the carotid artery would have the effect of checking and curing the disease; an expectation, which was warranted by analogous instances, in which the growth of swellings, and their dispersion, are brought about by lessening the quantity of blood determined to them. The experiment completely succeeded; the swellings in the vicinity of the eye subsided; the patient was freed from several grievous complaints, to which she had been previously subject; and among other benefits, a cure of the exophthalmia was one result, which most interests us in the present place. The case is also highly important on other accounts, and more particularly, as confirming the fact, that the carotid artery may be tied, without any dangerous effects on the brain, and as proving, that in cases of aneurism, the surgeon should not be afraid of proceeding to such an operation. (See *Med. Chir. Trans. Vol. 2, Art. 1.*) The judgment and decision, with which Mr. Travers acted in this case, appear to me highly meritorious.

The carotid artery has also been tied by Mr. Dalrymple, surgeon at Norwich, in a case very similar to the preceding, and with equal success. (See *Med. Chir. Trans. Vol. 6, p. 111, &c.*)

When the causes of exophthalmia have been removed, the eye must be put into its natural situation. If the organ has been long displaced, the surgeon often finds the fulfilment of this indication attended with difficulty. Indeed, he is frequently obliged to employ methodical bandages for the purpose of promoting the gradual return of the eye into the orbit. Yet, even in such cases, the eyesight is often regained; but, if this should not happen spontaneously, stimulants and tonics are to be tried. (See *Amaurosis*.)

Fab. Hildan centur. 6, obs. 1. Vander Wiel, centur. 2 obs. 9. Paw, obs. anat. 23. Tulpius, lib. 1, cap. 23. Hope, in Phil. Trans. for 1744. Louis sur plusieurs Maladies du Globe de l'Œil, &c. in Mém. de l'Acad. de Chirurgie, T. 13, in 12mo. Brocklesby, in Medical Obs. and Inquiries, Vol. 4, p. 371. White's Cases in Surgery, p. 131—135, &c. Warner's Cases in Surgery, p. 108. Edit. 3. Lassus, Pathologie Chir. T. 2, p. 144, Edit. 2. Richerand, Nosogr. Chir. T. 2, p. 117, Edit. 2. Med. Chir. Trans. Vol. 2, art. 1, Vol. 4, p. 316, and Vol. 6, p. 111, &c. Richter's An-

fangsgr. der Wundaran. B. 3, p. 406, &c., Gott. 1795. The matter in this last Work forms the basis of the foregoing observations. Langenbeck, Neue Bibl. B. 2. Petitbeau, in Journ. de Méd. par Corvisart, T. 14.

EXOSTOSIS. (From $\epsilon\kappa$, out, and $\sigma\sigma\epsilon\upsilon$, a bone.) An exostosis is a tumour formed by an exuberant growth of bony matter on the surface of a bone, or as Boyer says, it is formed by the more or less considerable enlargement of a part, or the whole of a bone. (*Traité des Mal. Chir. T. 3, p. 541.*)

If bones resemble the soft parts of the body in their structure, they must resemble them in their diseases, and of course be liable to various kinds of tumours. Nay, an extraordinary increase of the size and density of all the bones of an individual has been observed, which affection ought probably also to be classed with the disease, to which surgeons usually apply the term exostosis.

The generality of writers, even the most modern, have admitted many diseases among exostoses, which ought to be considered in a very distinct light: I need only instance the *spina ventosa*.

One division of exostoses is into *true* and *false*; the former being of a truly osseous consistence, the others being more or less hollow, spongy expansions of the bones, sometimes containing a quantity of fleshy, fungous matter within the shell of the disease. Periostoses, or mere thickenings of the periosteum, are also classed among the *false* exostoses. (*Dict. des Sciences Med. T. 14, p. 218.*) According to Mr. A. Cooper, exostoses have two different seats: by *periosteal* exostosis, this author means an osseous deposition seated between the external surface of the bone, and the internal surface of the periosteum, and firmly adherent to both; by *medullary* exostosis, he signifies a similar formation originating in the medullary membrane, and cancellated structure of a bone. The same experienced surgeon makes two other general divisions of exostoses into the *cartilaginous* and *fungous*, the first being "preceded by the formation of cartilage, which forms the nidus for the ossific deposit," while the second is a tumour softer than cartilage, yet firmer than fungus, in other parts of the body, containing spicula of bone, being of a malignant nature, and depending "upon a peculiar state of constitution and action of vessels." It is a disease similar to "fungus hæmatodes, but somewhat modified by the structure of the part in which it originates." (*Surgical Essays, Part 1, p. 155*) This last form of exostosis is probably the disease treated of in another part of this dictionary, under the title of *Osteosarcoma*.

Exostoses differ very much in respect to size. Those of the cranium are generally small and circumscribed. Exceptions occur, however, for we learn, that Sir Everard Home removed a very large tumour, which had a bony base, and was situated on the head. (*A. Cooper, Surgical Essays, Part 1, p. 156.*) The largest *true* exostoses met with are such as are formed upon the long

bones. In the history of surgery may be found numerous cases of enormous exostoses; but it is worthy of notice, that these were nearly all of them of the species termed *false*, and many of them were situated in the jaw, the clavicle, or the extremities of the long bones. Observations of this kind are abundant in l'Histoire de l'Acad. des Sciences; les Mem. de l'Acad. de Chir.; the Sepulchretum Anatomicum; the writings of Morgagni, &c. (*Dict. des Sciences Med. T. 14, p. 219.*)

The bones most frequently affected with exostosis, are those of the cranium, the lower jaw, sternum, humerus, radius, ulna, bones of the carpus, and particularly the femur, and tibia. There is, however, no bone of the body, which may not become the seat of this disease. It is not uncommon to find all the bones of the cranium affected with exostosis, and the ossa parietalia sometimes an inch thick.

According to Mr. A. Cooper, the exostosis, which forms between the outer table of the skull and the pericranium, is of an extremely hard consistence, and generally attended with little pain, while the *fungous* exostosis, springing from the diploe of the skull, is less firm, and more vascular. It is described as being of a malignant nature, making its way through the inner table, and occasioning disease of the dura mater, and fatal effects on the brain. (*Surgical Essays, Part 1, p. 156.*)

Sometimes as Boyer remarks, the tumour is confined to a small part of the affected bone, composing a mass superadded to its surface, and of various shapes. Sometimes it rises insensibly, having no very distinct limits, and resembling a more or less regular portion of a sphere. In some instances its figure is styloid, and it projects in a greater or less degree. On other occasions, its base is rendered distinct by a pedicle, or contraction, which varies in breadth and length in different cases. In particular instances, the exostosis, though limited to the surface of a bone, occupies the whole extent of it. Thus, the whole external surface of one of the bones of the skull has been found occupied by an exostosis, while the cerebral surface of the same bone was in the natural state. The whole circumference of the femur sometimes acquires an enormous size, at the same time that the medullary surface of the same bone continues entirely unchanged. These are the *periosteal* exostoses of Mr. Cooper. In other examples, on the contrary, the two surfaces and the whole thickness of the bone are deformed by an augmentation of bulk; and when this happens in a cylindrical bone, the medullary cavity is more or less reduced, or even totally obliterated. There are a few extremely uncommon cases, in which the substance of a bone acquires great solidity, and a hardness compared to that of ivory, without any material increase of bulk. An exostosis rarely occupies the whole extent and thickness of a bone; but when this happens in a

cylindrical bone, the articular surfaces generally remain in their natural state.

The structure and consistence of exostoses present great differences. Sometimes, especially when the tumour is not very large, and it is situated on the surface of a cylindrical bone, one may trace with the eye the diverging of the osseous fibres, in the interspace of which one would say, that there is deposited a new bony substance, the organization of which is less distinct. Sometimes the tumour is entirely cellular, and formed of a few broad laminae, intercepting extensive spaces, which are filled with matter different from the medulla, and of various quality. This case is denominated the *laminated exostosis*. Sometimes the enlarged portion of bone makes a sort of hollow sphere, with thick hard walls, and the cavity of which is filled with fungous granulations more or less extensive and indolent. According to Boyer, this variety of the disease differs essentially from osteosarcoma, notwithstanding external appearances. The case here alluded to, I conclude to be the same as that which Mr. A. Cooper has named the *cartilaginous exostosis of the medullary membrane*. "In this case, the shell of the bone becomes extremely expanded, or rather the original shell is absorbed, and a new one deposited; and within this ossified cavity, thus produced, a very large mass of cartilage is formed, elastic, firm, and fibrous." It is not malignant, but often ends in a very extensive disease. (*A. Cooper, Surgical Essays, Part 1, p. 173.*)

In other instances, the tumour is perfectly solid, exceeding in consistence that of the hardest bones, and equalling that of ivory. Here, the surface is sometimes smooth, and like that of the bone in its natural state; sometimes irregular, full of little projections, and in some degree stalactitical. It is very uncommon to find a large portion of an exostosis converted into a pulsatous substance; but it is not at all unfrequent to see this substance composing part of the tumour. Lastly, it very often happens, that the same exostosis presents an assemblage of the ivory substance, and of the cellular laminated substance, the cavities of which are partly filled with a pulsatous matter, and partly with a sort of gelatinous substance.

When an exostosis is not very large, it hardly affects the surrounding soft parts; but when it has made considerable progress, the muscles become stretched and emaciated, the cellular substance is thickened, and, its layers being adherent together, a kind of confusion is produced among all the adjacent parts. Exostoses not of considerable size may, however, seriously interrupt the functions of certain organs. The action of the flexor muscles of the leg has been known to be obstructed by an exostosis in the vicinity of the knee. A similar tumour arising near the symphysis pubis need not be very large to impede considerably the functions of the urethra, as experience has proved. An exostosis in the orbit has been known to displace the eye and destroy vi-

sion. Lastly, exostoses, when situated near certain important organs, and of large size, may affect with different degrees of gravity the functions of these parts, as the brain, the lungs, &c. (See *Boyer, Traité des Mal. Chir. T. 3, p. 541—544.*)

Mr. A. Cooper has related a case, in which the eyes were pushed out of their sockets by two exostoses, which grew from the antra, and one of which destroyed the patient by making its way to the brain through the orbital process of the os frontis. (*Surgical Essays, Part 1, p. 157.*) In one instance, reported by the same author, an exostosis from the sixth or seventh cervical vertebra abolished the pulse at the wrist, by pressing upon the subclavian artery. (*P. 159.*) In another, a *cartilaginous exostosis* of the medullary membrane of the lower jaw extended so far back that it pressed the epiglottis down upon the rima glottidis, and caused such difficulty of respiration, and so much irritation, that the patient was destroyed. (*P. 175.*)

Venerereal exostoses, or nodes, are observed to arise chiefly on compact bones, and such of these as are superficially covered with soft parts, as for instance, the bones of the cranium, and the front surface of the tibia.

The causes of exostosis do not seem to be at all understood. Most writers impute the disease to internal causes, such as scrofula and lues venerea. That the latter affection is the cause of nodes, which are certainly a species of exostosis, no one will deny; but, that scrofula is ever concerned in producing any of the other kinds of exostosis must not be admitted, at least, before some evidence is adduced in support of the doctrine. Boyer, however, and all the surgeons of the continent adopt the opinion, that scrofula is sometimes a cause of the disease.

Hydatids are occasionally found within exostoses, in which circumstance the former are supposed to be the cause of the enlargement of the bone. A remarkable specimen of such a disease in the tibia is mentioned by Mr. A. Cooper. (*Surgical Essays, Part 1, p. 163.*) He refers also to a humerus, in the museum of St. Thomas's Hospital, where the shell of the bone is considerably expanded, the periosteum over it thickened, and in the seat of the cancellated structure, several hydatids, supposed to have been the cause of the enlargement of the exterior surface of the bone, as well as of the increase of its cavity. (*Vol. cit. p. 161.*) A most interesting case of a bony tumour on the forehead, containing hydatids, has likewise been recently published by Mr. R. Keate. (*Med. Chir. Trans. Vol. 10, p. 278.*)

The ease with which bony tumours form in some persons, is a curious and remarkable fact, and renders it probable, that constitutional causes here have great influence. Thus, such a blow, as in the generality of persons, would hardly excite notice, will, in others, bring on swellings of the bone, which is struck. Mr. A. Cooper adverts to a young friend of his, in whom an exostosis, which was undoubtedly caused by a blow,

is growing on the metacarpal bone of the little finger. (*loc. cit.*) I remember, that Mr. Abernethy mentions, in his lectures, his having seen a boy from Cornwall, who was so excessively afflicted with an apparent predisposition to exostoses or an exuberant deposition of bony matter, that a very trifling blow would occasion a bony swelling on any bone of his body. His ligamentum nuchæ was ossified, and prevented the motion of his neck; the margins of his axillæ were also ossified, so that he was, as it were, completely pinioned. Besides all this, the subject in question had numerous other exostoses on various parts of his body. Mr. Abernethy gave, in this case, muriatic and acetic acids, with a view of dissolving the lime, which this gentleman thought might be too abundant in the system; but, even if this theory had been correct, and the acids capable of the chymical action intended, after passing into the circulation how could they be expected to dissolve only the redundant depositions of phosphat of lime, and at the same time leave the skeleton itself undissolved?

When an exostosis depends upon lues venerea, it is almost always preceded by an acute pain, which in the beginning extends to nearly the whole of the affected bone, but afterward becomes fixed to the point where the exostosis forms, and it is most severe in the night-time. When an exostosis is caused by scrofula, says Boyer, the pain is duller, or rather it is quite inconsiderable. It is the same with the exostosis, which succeeds a blow, or contusion, without any manifest general cause. In the latter example, the pain immediately excited by the accident subsides in a few days, and the swelling occurs so slowly, that no notice is taken of it till it has attained some magnitude. (*Traité des Mal. Chir. T. 3, p. 545.*)

An exostosis constantly feels hard; but its size is various, and it may be indolent, or painful. By these signs, and its firm adhesion to the bones, it may be always distinguished from other tumours. Some exostoses cannot be ascertained before death. Such was the case in which the parietal bone was found, after death, to be three times thicker than natural. Such also was the example related in the memoirs of the Academy at Dijon, in which a person died from an exostosis on the internal side of the os pubis, which tumour prevented the discharge of the urine, or the introduction of a catheter, by its pressure on the neck of the bladder.

Exostoses may be either *acute* or *chronic*, in their progress. In the first case, which, according to Boyer, happens most commonly in the *cellular* exostosis, described by authors under the name of *laminated*, the appearance and formation of the tumour are quick; the swelling rapidly acquires a considerable size; and it is always preceded by, and accompanied with, continual violent pain, which the external and internal use of opium has little effect upon, and the intensity of which is not increased by pressure.

The pain is sometimes so severe that it occasions a good deal of symptomatic fever. Boyer, who seems not to be aware of the origin of what he terms the *cellular*, and what Mr. A. Cooper has named *fungous exostosis*, from the medullary membrane, finds difficulty in accounting for the rapid growth, and great sensibility of the tumour, considering the natural density of the bones, and the little energy of their vital properties.

In the hardest kinds of exostosis, says Boyer, the tumour is preceded by no pain, or, if any, it is very slight; the tumour grows slowly; and, although it sometimes attains a considerable size, its increase is attended with no particular sensibility, and no disturbance of the animal economy. (*Boyer, op. cit. T. 3, p. 546.*)

Our ignorance of the pathology of exostoses, particularly their causes, accounts for the imperfection of our treatment of them. With the exception of the venereal exostosis, or node, there is no species of this affection, for which it can be said, that we have any one medicine of efficacy.

Boyer, and other writers on the diseases of the bones, seem to regard some exostoses as a perfectly inorganic mass of lime, and, consequently they entertain no idea, that the absorbent vessels can possibly take away the particles of the tumour, just as the secreting arteries have laid them down. Such writers, however, are well aware, that nodes are capable of being diminished, and this can only be effected by the action of the absorbent system.

Boyer does acknowledge, indeed, that he has seen a venereal exostosis of the humerus, as well as a few other bony swellings, subside; but he represents the event as extremely rare; and he advances it as a principle, that the resolution of exostoses hardly ever happens, and that the greater part of the examples, recorded in proof of the occurrence, were nothing more than periostoses. (*P. 547.*)

When an exostosis is hard, chronic, and free from pain and alteration of the structure of the bone, it is a much more common thing for it to cease to enlarge and remain stationary during life, without producing inconvenience, provided it be so situated as not to impede the functions of any vital organ.

But, in the *cellular* exostosis of Boyer, which I take to be the same disease as the *fungous* exostosis of the medullary membrane of Mr. A. Cooper, the acute and rapid progress of the disease indicates a deeper and more serious alteration of the texture of the bone. A part of the tumour usually consists of a pultaceous, or gelatinous matter, and the rest, still endued with its natural organization, though altered by the disease, soon presents one or several cavities, in which there is suppuration. At the same time, the external soft parts, being excessively and rapidly distended, inflame, ulcerate, and leave exposed a more or less extensive portion of the tumour, the disease of which has in many cases been very wrongly supposed to be caries. It is not, observes Boyer, that the

part of the swelling denuded by ulceration is not sometimes affected with caries; but, then it exists as a complication of the original disease, and as a particularity, by no means the result of the ulceration of the soft parts, and of the exposure of the diseased bone to the contact of the air. When the soft parts are thus ulcerated, the opening contracts to a certain point, and becomes fistulous. The suppuration is always of bad quality, and in a quantity proportioned to the size of the cavity of the abscess and the strength of the patient. The fever, which commences at an early period of the disorder, assumes a slow type, and its continuance, together with the copiousness of the ichorous discharge, the irritation, &c. may bring on the patient's dissolution.

The following are the symptoms of what Mr. A. Cooper denominates the *fungous exostosis of the medullary membrane*. The disease begins with a general enlargement of the affected part of the limb, extending a considerable way around the seat of the exostosis itself. This form of the complaint mostly occurs in young persons, though Mr. A. Cooper has seen it in an individual fifty years old. "Its increase proceeds very gradually; and even when it has acquired considerable magnitude, although it produces some diminution of motion in the limb, it does not occasion pain, or prevent the patient from using it. When any pain does arise, it is of an obtuse kind, only being acute in the event of a nerve being stretched by the tumour. Thus an exostosis of the thigh bone sometimes causes great agony, by pressing on the sciatic nerve. Paleness, debility, and irregularity of the bowels, are observed to attend the early stage of the disease; and afterward the complexion becomes sallow. In the mean time, the diseased part of the limb attains an enormous size; but the skin retains its natural colour. At many points, the swelling feels hard; at others, it is so elastic as to cause the presence of fluid to be suspected; but, if an opening be made, only blood is discharged. The surface of the tumour next becomes tuberculated, and the prominences tender, and their surface is often slightly inflamed. The rest is now broken, the appetite impaired, and the bowels extremely irregular. At length, the tubercles ulcerate; the skin secretes pus; but, when the swelling itself is exposed, it discharges a bloody-coloured serum. A fungus then forms, which sometimes bleeds profusely, and, after it has risen very high, sloughing occurs, and considerable portions of the swelling are thrown off. But, although the swelling may be lessened by this process, Mr. A. Cooper has never known the disease cured by it; and, in the end, the patient is destroyed by the effects of the repeated bleeding, immense discharge, and constitutional irritation." In this disease, as in common fungus hæmatodes, tumours of a similar nature are often formed in other parts of the body, and, after the amputation of the affected bone, frequently make their appearance in organs of the greatest importance to life. The swelling is described as originating from the medullary membrane, and as

removing the muscles to the distance of three inches, or more, from the bone, so that they represent a thin layer spread over the tumour. The blood-vessels and large nerves are also similarly displaced. The tuberculated appearance of the skin, which is itself sound, is caused by projecting small masses on the surface of the tumour. Under the muscles is the periosteum, pushed to a considerable distance from the bone. A part of the swelling itself is yellow, like fat; another portion resembles brain; and a third is composed of coagulated blood with interstices filled with serum. In some parts, the white substance is found nearly as firm as cartilage; but, in general, it presents a more spongy appearance; and is interspersed with spiculae of bone. The shell of the bone itself is in part absorbed; in some places, it is only thinner than usual; while in others it is immensely expanded, so as to form a case, like wire-work, over the tumour. The fungous granulations, proceeding from the medullary membrane itself, are exceedingly vascular, and often shoot from the cavity of the bone beyond the level of the integuments. (*A. Cooper, Surgical Essays, Part 1, p. 165—168.*)

According to Boyer, spherical exostoses, with an internal cavity, and hypersarcosis, are only attended with violent pain in the beginning, and when they have attained a considerable size, they become almost indolent. But, the successive formation of the fungosities, contained in their cavity, has the effect of distending its parietes, and rendering them thin, so that such exostoses are exposed to fractures and ulceration. This last effect may, indeed, be a consequence of the progress of the disease, and give rise to a series of consecutive symptoms, which may be compared with those which have been described in the preceding case. The spherical exostosis, however, is less dangerous, perhaps, because the disease extends less deeply. Such tumours admit of being directly attacked, and operations for the destruction of the bony shell, and of the fungous growth, which it includes, may be successfully practised; an attempt, which would certainly be useless and dangerous in the foregoing instance.

One termination of exostosis, not spoken of by writers, but which has been observed, especially in the hard and stalactitical exostosis, is that by necrosis. Tumours of this description, after acquiring a large size, have been attacked with mortification, separated from the bone, which served them as a base, and surrounded with a reproduction in every respect similar to that, with which nature surrounds sequestra formed under any other circumstances. This termination is undoubtedly the most favourable of all, because nature proceeds in it slowly, without any violent disturbance; but unfortunately, it is the least common. Art can imitate it; but her means are very inferior to those of nature. (*Boyer, Traité des Mal. Chir. T. 3. p. 547—550.*)

The hardest exostosis, which has grown slowly, and without causing severe pain, is the least dangerous of all, especially when

the constitution is sound, and the patient not of a bad habit. After the disease has attained a certain size, it may become stationary, and continue in this state, without inconvenience, during life. This is most frequently observed in the *ivory* exostosis. Without having precisely this extreme hardness, however, some exostoses which are tolerably solid, and in which the natural organization of bone is still distinguishable, are capable of undergoing a slight reduction after the removal of their cause by nature or art. Boyer states, that this sometimes happens in a few scrofulous exostoses, and particularly in such as are venereal, and not of very large size.

The *cellular* exostoses of Boyer, the *fungous* exostosis of Mr. A. Cooper, and the cases which are named *osteosarcomata*, are the most serious of all, especially when the texture of the bone is considerably altered, and the disease is in a state of ulceration. The rapid formation of the disease, the violent shock which it imparts to the constitution, and the hectic disturbance which it excites, generally bring the patient into imminent danger, and commonly leave no other resource but that of amputating the limb.

The treatment of exostoses is to be considered in a medical and surgical point of view. When any general cause of the disease is known, or suspected, such cause is to be removed by those means which experience has proved to be most efficacious. Thus Boyer recommends mercurial and antiscrofulous remedies, &c. according to the nature of the case.

Whatever may be the species of exostosis, or the nature of its cause, relief, says Boyer, may be derived from the outward use of opium, whenever the disease is attended with severe pain. He speaks favourably of the application of a linseed-meal poultice, made with a decoction of the leaves of nightshade and henbane, to which a strong solution of opium has been added. But he thinks that an antiphlogistic plan, with bleeding, is hardly ever admissible, because it weakens the patient too much in so tedious a disease, and can only be a palliative, incapable of curing, or preventing the ravages of the disorder.

When there is no pain, or it has been appeased, during or after any general method of treatment, which may have been indicated, the surgeon may try resolute applications, particularly soap and mercurial plasters, volatile liniment, bathing in water containing a small quantity of soda, or potassa, hydro-sulphurated washes, &c. Boyer acknowledges, however, that the progress of exostoses can scarcely ever be checked by any general methodical treatment. The muriatic and acetic acids have been administered, but without effect; nor am I acquainted with any remedies which possess efficacy, excepting mercury, which we know will rarely answer, except in cases of nodes. In the commencement of any deep-seated disease in a bone, however, Mr. A. Cooper thinks, that the best medicine for internal exhibition,

is the oxymuriate of quicksilver in small doses, together with the compound decoction of sarsaparilla. (*Surgical Essays*, Part 1, p. 169.) Boyer is firmly of opinion, that with the exception of recent small exostoses, the nature of which is even doubtful, the resolution of such tumours is almost impossible. A slight diminution of the swelling, and its becoming perfectly indolent, are the most favourable changes which can be hoped for, whether they occur spontaneously, or are the fruit of surgical assistance. (*Traité des Mal. Chir.* T. 3, p. 554—557.)

Whether any exostoses might be lessened by keeping open a blister over them, for a considerable time, is a point, perhaps, worthy of further investigation. It is certain, that such applications tend to diminish venereal nodes, after they have been lessened as much as they can be by mercury; and we also know, that blisters, kept open, promote the absorption of the dead bone in cases of necrosis. In the local treatment, Mr. A. Cooper approves of the use both of leeches and blisters, a discharge from the latter being kept up with equal parts of the mercurial and savin ointments. (*Surgical Essays*, Part 1, p. 169.)

When exostoses merely occasion a deformity, and no pain, nor inconvenience, from the pressure which they produce on the neighbouring parts, it is certainly most advisable not to undertake any operation for their removal; for, as Boyer has truly observed, in by far the greater number of instances, the local affection is much less to be dreaded, than the means used for removing it.

Caustics and the cautery have occasionally been applied to exostoses; but they mostly do mischief. Boyer mentions an unfortunate woman, who had some caustic applied to an exostosis at the inside of the tibia; but which, instead of removing the tumour, caused a necrosis, of which she was not well two years afterward. In a few instances, however, after the removal of fungous, or cartilaginous exostoses, of the interior of a bone with cutting instruments, the application of the cautery has prevented a reproduction of the diseased mass, as we find exemplified in a case recorded by Mr. A. Cooper, where such a disease of the jaw was thus extirpated. (*Surgical Essays*, Part 1, p. 158.) The bold and successful manner also in which the hydatid exostosis of the head was attacked with the saw, caustics, and the actual cautery, by Mr. R. Keate, is particularly entitled to the attention of the surgical practitioner. (*Med. Chir. Trans.* Vol. 10, p. 288, &c.) As far as my information extends, no attempt to stop the progress, and effect the cure of a fungous exostosis, by tying the main artery of the limb, has ever yet succeeded. Two cases, proving the inefficacy of this practice, are detailed by Mr. A. Cooper. (*Vol. cit.* p. 170.)

As the *fungous exostosis* of the medullary membrane is evidently connected with a state of the constitution, analogous to what prevails in fungous hamatodes, (see *this word*)

the permanent success of amputation should never be too boldly premised; but, as no medicines have any material power over the disease, and the operation is the only chance of relief, it ought to be advised.

Cartilaginous exostoses of the medullary membrane may sometimes be extirpated by removing their outer bony covering, and then cutting away the cartilaginous matter closely from the bony surface to which it is attached. Sometimes, as I have noticed, these measures are followed by the use of the actual cautery.

Periosteal exostoses are also either *cartilaginous*, or *fungous* which latter are attended with less general swelling of the limb, and are more prominent than fungous exostoses of the medullary membrane. Ulceration, bleeding, sloughing, and great discharge ensue, and unless some operation be performed, the patient loses his life. (*A. Cooper, Surgical Essays, Part 1, p. 180.*)

The *cartilaginous exostosis, between the periosteum and bone*, arises from inflammation of the periosteum, and subjacent part of the bone, and a deposition of firm cartilage, adherent to both these surfaces, takes place. In this substance bony matter is secreted, which is first thrown out from the original bone. As the cartilage increases in bulk, the quantity of phosphate of lime augments, and fresh cartilage is constantly deposited upon the outer surface of the tumour. On dissection;—1st, the periosteum is found thicker than natural; 2dly, immediately below the periosteum, cartilage; and 3dly, ossific matter, deposited within the latter, from the shell of the bone, nearly to the inner surface of the periosteum. When the growth of such a swelling ceases, and the disease is of long standing, the exterior surface consists of a shell of osseous matter, similar to that of the original bone, and communicating with its cancelli, in consequence of the primitive shell having been absorbed. (*A. Cooper's Surgical Essays, Part 1, p. 186.*) The *periosteal cartilaginous exostoses* constitute the indolent, very hard forms of the disease. In their early stage they may sometimes be checked by small doses of mercury, the decoction of sarsaparilla, and the emplastrum ammoniaci cum hydrargyro. (*Vol. cit. p. 196.*) When large, or troublesome, they may be sawn away, as Mr. A. Cooper states, without danger, if the disease be well discriminated from the fungous swelling.

When exostoses are productive of much pain and injure the health, and their situation admits of their being safely removed, with the aid of suitable saws, or even with that of a gouge and mallet; the operation may be undertaken. Many tumours of this kind, however, have bases so very extensive and deep, that, when situated on the limbs, amputation becomes preferable to any attempt made to saw or cut away the exostoses, and preserve the members on which they are situated.

In removing an exostosis, its base must be as freely exposed by the knife as circumstances will allow, and to this part a small fine saw

may be applied. In cutting away some exostoses, the flexible saw, described by Dr. Jeffray, of Glasgow, (see *Amputation*), will be found useful. Mr. Hey's saws are now so well known to the profession, that I scarcely need recommend them to be remembered in the present cases. Mr. Machell, a surgeon in London, has invented a saw, well calculated for cutting a bone at a great depth, without injuring the muscles. It is a small, fine, perpendicular wheel-like saw, turned by means of a handle connected with machinery. It is highly commended by Mr. A. Cooper, who has given a drawing of it in his *Surgical Essays, Part 1*. An orbicular saw, invented and used by Professor Graefe, of Berlin, likewise merits particular notice on account of its ingenuity. (See *C. G. E. Schwalb de Serra Orbiculari, 4to. Berol. 1819.*) A strong pair of bone-nippers will also be useful.

E. Victorin de Ossibus tuberosis Upsal. 1717. Haller, Disp. Chir. 4, 561. P. H. Mehring de Exostosi Steatomatode Claviculæ, ejusdem felici Sectione. Gedani. 1732. J. Caspart de Exostosi Cranii rariore. Argent. 1730. J. R. Fayolle, de Exostosi. Monsp. 1774. Abernethy, in Trans. for the Improvement of Med. and Chir. Knowledge, Vol. 2, p. 309. Bonn, Descriptio Thesauri Ossium Hoviani. Dumont Jour. de Med. T. 13; Hist. de l'Acad. des Sciences. 1737, p. 28; Houslet, in Mem. de l'Acad. de Chir. T. 3.; Matuni de Osseis Tumouribus, p. 20; Petit, Traité des Mal. des Os, T. 2. Morgagni de Sedibus, &c. Ep. 50. art. 56. Kulmus de Exostosi Claviculæ. Haller Collect. Diss. Chir. 4. R. Keate in Med. Chir. Trans. Vol. 10; A. Cooper, Surgical Essays Part. 1. 8vo. Lond. 1818. J. F. Lobstein, Compté de son Muséum Anatomique, p. 24 &c. 8vo. Strasb. 1820.

EXTIRPATION. (from *extirpo*, to eradicate.) The complete removal or destruction of any part, either by cutting-instruments, the action of caustics, or the application of a ligature.

EXTRACTION. (from *extraho*, to draw out.) The taking extraneous substances out of the body. Thus bullets and splinters are said to be *extracted* from wounds; stones from the urethra, or bladder.

Surgeons also sometimes apply the term, *extraction*, to the removal of tumours out of cavities, as for instance, to the taking of cartilaginous tumours out of the joints; they seldom speak of extracting any diseased original part of the body; though they do so in one example, viz. the cataract.

EXTRACTION OF THE CATARACT. See *Cataract*.

EXTRAVASATION. (from *extra*, out of, and *vas*, a vessel.) A term applied by surgeons to the passage of fluids out of their proper vessels, or receptacles. Thus when blood is effused on the surface, or in the ventricles of the brain, it is said, that there is an *extravasation*.

When blood is poured from the vessels into the cavity of the peritoneum, in wounds of the abdomen, or when the contents of any of the intestines are effused in the same way,

surgeons call this accident an *extravasation*. The urine is also said to be *extravasated*, when, in consequence of a wound, or of sloughing, or ulceration, it makes its way into the cellular substance, or among the abdominal viscera. When the bile spreads among the convolutions of the bowels, in wounds of the gall bladder, this is a species of extravasation.

In wounds of the thorax, an extravasation of blood also frequently happens in the cavity of the pleura. Large quantities of blood are often extravasated in consequence of vessels being ruptured by violent blows: in the scrotum, on the shoulder, and under the scalp, this effect is observed with particular frequency.

In the articles, *Head*, *Injuries of*, and *Wounds*, I have treated of extravasations of blood in the cranium, chest, and abdomen.

EYE, CALCULUS IN THE INTERIOR OF. Scarpa has dissected an eye, which was almost entirely transformed into a stony substance. It was taken from the body of an old woman, and was not above half as large as the sound one. The cornea appeared dusky, and behind it the iris, of a very singular shape, was distinguishable, being concave, and without any pupil in its centre. The rest of the eyeball, from the limits of the cornea backward, was unusually hard to the touch.

On making an incision, Scarpa found the sclerotica and choroides almost in their natural state, and a small quantity of limpid fluid issued from the anterior chamber of the aqueous humour. Beneath the choroides, two hard calculeous concave plates presented themselves, united together by means of a complete membranous substance. One was situated forward; the other backward: the latter occupied the bottom of the eye; the former the situation of the corpus ciliare and crystalline lens.

Scarpa made an incision, through the compact membrane, which joined together the margins of the two calculeous bodies. He found in the cavity, instead of the vitreous humour, some drops of a glutinous bloody fluid, and in the longitudinal direction of this cavity, a little soft cylinder, which, extending forward from the bottom of the eye, along the great axis of this organ, was inserted into a cartilaginous, elastic substance, situated in the centre of the front calculeous body, precisely where, in the natural state, it is customary to find the lens and its capsule, which were entirely wanting.

The posterior surface of the iris had formed a firm adhesion to the middle of the cartilaginous substance, situated in the centre of the front calculus. Hence, the iris, when beheld on the side next the cornea and anterior chamber, appeared as it actually was, concave in the middle.

The optic nerve, which had degenerated into a mere thread, entered the sclerotica and choroides, as well as the centre, or bottom, of the posterior calculeous body, and lost itself in the little soft cylinder, which, as was explained, proceeded to be inserted

in the cartilaginous substance, situated in the middle of the anterior calculus, or the place naturally occupied by the lens and its capsule. The greater part of this little cylinder was, according to appearance, nothing else than the membrane of the vitreous humour, destitute of fluid, shrivelled, and changed into a compact substance. Haller met with a similar case. (See *Obs. Pathol. Oper. Min. Obs.* 15.) Fabricius, Hildanus, Lancisi, Morgagni, Morand, Zinn, and Pellicier, make distinct mention of calculi in the interior of the eye. (*Scarpa sulle Malattie degli Occhi. Venezia, 1802.*) Ossifications of the capsule of the lens, of that of the vitreous humour, and of what was supposed to be, the hyaloid membrane are noticed by Mr. Wardrop. (*Morbid Anatomy of the Human Eye, Vol. 2, P. 128. 8vo. Lond. 1818.*)

EYE, CANCER, AND EXTIRPATION OF. One of the well-known characters of carcinoma in general is to attack persons advanced in age, rather than children and young subjects. Hence, an observation made by the experienced Desault, that cancer of the eye is most frequent in childhood, could not but appear a position inconsistent with the usual nature of the disease in general. Yet, how was this statement to be contradicted, while it was confirmed by the testimony of Bichat himself, who says, that more than one-third of the patients on whom Desault operated in the Hôtel Dieu for cancer of the eye, were under twelve years of age? Here truth and accuracy, as in many other questions relative to disease, would never have been attained without the aid of morbid anatomy, whereby distempers, which bear a superficial resemblance to each other, while they are in reality of a totally different nature, are prevented from being confounded together. Now when Scarpa even goes further than Bichat, and asserts, that in twenty-four individuals, affected with what is called carcinoma of the eye, twenty of those, at least, are children under twelve years of age, this declaration, considered with the acknowledged propensity of cancer, on all other occasions, to attack old rather than young subjects, might have remained a mysterious anomaly in the history of disease, had not the valuable investigations of Mr. Wardrop proved beyond all doubt, that the afflicting disease which rendered it necessary for so many young subjects to undergo a severe operation, was not true cancer, but what is now denominated by modern surgeons, *fungus hæmatodes*. (*Obs. on Fungus Hæmatodes. 8vo. Edinb. 1809.*) As Scarpa observes, this author has afforded a solution of the question, by showing, from careful observation, founded on pathological anatomy, that the morbid change of structure in the eyeball of a child, commonly called carcinoma, is not in reality produced by cancer, but by another species of malignant fungus, to which the epithet hæmatodes is applied; a disease, indeed, equally, and, with regard to the eye, more formidable and fatal, than cancer, but distinguished from it by peculiar characters, which not being confined to age, sex, or part

of the body, attacks the eyeball both of the infant and adult. (*Scarpa, Trans. by Briggs, P. 502. Ed. 2.*)

According to Scarpa, and indeed, the sentiments of several other surgeons of the present day, cancer is always preceded by scirrhus, or a morbid induration of the part affected. As the disorganization increases in this hard scirrhus substance, an ichorous fluid is formed in cells within it, and afterward extends towards the external surface of the tumour, causing ulceration of the investing parts. The compact, and apparently fibrous mass is then converted into a malignant fungous ulcer, of a livid, or cineritious colour, with edges everted, and irregularly excavated, and with a discharge of acrid, offensive sanies. The scirrhus, composing the base of the malignant fungus, instead of increasing in size, now rather diminishes, but retains all its original hardness, and, after rising a certain way above the ulcerated surface, is destroyed at various points by the same ulcerated process, from which it originated. And, if any part of the livid fungous sore seem disposed to heal, it is a deceitful appearance, as, in a little time, the smooth points are again attacked by ulceration. To relate in this place all the differences between cancer and fungus hæmatodes of the eye, would be superfluous, as the subject is considered in a future article (See *Fungus Hæmatodes*;) but, I may briefly advert to a few remarkable points of diversity; 1st. The primary origin of fungus hæmatodes is generally in the retina, especially, that point at which the optic nerve enters the cavity of the eye. 2dly. True cancer of the eyeball, when it begins on any part of the organ itself, instead of commencing as fungus hæmatodes at the deepest part of the eye, originates on its surface in the conjunctiva; and, as far as present evidence extends, if we except the lachrymal gland, this membrane is the only texture, connected with the eye, ever primarily affected with carcinoma. (*Scarpa on Diseases of the Eye, p. 526, Ed. 2; and Travers, Synopsis of the Diseases of the Eye, P. 99.*) 3dly. Cancer of the eye, as Scarpa truly observes, is less destructive than fungus hæmatodes, and that for two important reasons. In the first place, because carcinoma begins on the exterior parts of the eye, so that whatever relates to the origin and formation of the disease is open to observation; and secondly, because the cancerous fungus of the eye, on its first appearance, is not actually malignant, but becomes so in process of time, or from improper treatment, previously to which period good surgery may be employed with effect. In this light, Scarpa views many excrescences on the conjunctiva and anterior hemisphere of the eye, which appear in consequence of a straphyloma of the cornea, long exposed to the air and ulceration; those which arise from relaxation and chronic inflammation of the conjunctiva; from ulceration of the cornea, neglected or improperly treated;

from violent ophthalmia, not of a contagious nature, treated in the acute stage with astringent and irritating applications; from suppuration of the eye, rupture of the cornea, and wasting of the eyeball; or from blows, or burns on the part. Nothing, says Scarpa, is more probable, than that all these ulcerated fungi were, on their first appearance, not of malignant character, or certainly not cancerous, and that many of them were not actually so at the time of a successful operation being done.

Now, in the opinion of the same valuable author, there is no criterion as yet known of the precise time, when a sarcoma of the eye changes from the state of a common ulcerated fungus to that of carcinoma; for, the exquisite sensibility, darting pains, rapidity of growth, colour, and ichorous discharge, are not an adequate proof of cancer. The symptom, however, on which he is inclined to place the greatest dependence, as a mark of the change in question, is the almost cartilaginous hardness of the malignant ulcerated fungus, which induration, he asserts, is not met with in the benign fungus, and never fails to precede the formation of cancer. (See *Scarpa on the Eye, Transl. by Briggs, Ed. 2, p. 511—513.*)

4thly. The last difference of fungus hæmatodes from cancer of the eye, here to be noticed, is the pulpy softness of the whole of the diseased mass, in the first of these diseases; a character completely opposite to the firm, almost cartilaginous consistence of the carcinomatous fungus.

Before describing the operation of removing an eye, affected with malignant disease, the following corollaries, drawn by Scarpa, should be recollected. 1. The complete extirpation of the eye, for the cure of fungus hæmatodes, although performed on the first appearance of the disease under the form of a yellowish spot, deeply seated in the eye, is useless, and rather accelerates the death of the patient.

2. The exterior fungous excrescence of the eye, commonly called carcinoma, beginning on the conjunctiva, and anterior hemisphere, while it is soft, flexible, and pulpy, although accompanied with symptoms similar to those of carcinoma, is not actually this disease, nor does it become malignant, and strictly cancerous, until it is rigid, hard, coriaceous, warty, and, in every respect, scirrhus.

3. The inveterate fungous excrescence, hard to the touch in all its parts, covered with ulcerated warts, which has involved the whole of the eyeball, optic nerve, and surrounding parts, and rendered the bones of the orbit carious, and contaminated the lymphatic glands behind the angle of the jaw, and, in the neck, is incurable.

4. On the contrary, the partial, or total extirpation of the eye will succeed, when attempted before the external fungous excrescence has changed from the state of softness to that of a scirrhus, warty, and carcinomatous hardness. (*Vol. cit. p. 526.*)

The operation of removing the eye was

first performed in the sixteenth century by Bartsch, a German practitioner, who employed a coarsely constructed instrument, shaped like a spoon, with cutting edges, and by means of which the eye was separated from the surrounding parts, and taken out of the orbit. This instrument was too broad to admit of ready introduction to the deep contracted part of the orbit, so that, when it was used, either a part of the disease was likely to be left behind, or the thin bones of the orbit to be fractured in the attempt to pass it more deeply into that cavity. Fabricius Hildanus became acquainted with these inconveniences by experience, and, in order to avoid them, devised a sort of probe-pointed bistoury; a better instrument, but not free from objections, and forgotten for near a century afterward; surgeons continuing to use sometimes the cutting spoon, sometimes various kinds of hooks. Muys, Bartholine, &c. afford examples of operations so performed. Bidloo made use of scissors, and a pointed bistoury.

A lancet seemed to Lavanugon sufficient for extirpating the eye, and he is the first French surgeon who has spoken of this operation. All the surgeons of that country considered the operation as useless, cruel, and dangerous, until St. Ives mentioned, that he had done it with success. Heister preferred operating with the bistoury alone. Several English surgeons have used a sort of curved knife, an engraving of which is given in B. Bell's system; but, in dissecting the tumour, this instrument was regarded by Louis as less convenient than a straight bistoury.

Thus far the plans of operating, advised by authors, were not guided by any fixed rules. Louis endeavoured to lay down such rules, and for a long while his method was mostly adopted in France. It consists in dividing the attachments of the eye to the eyelids; then those of the small oblique muscle; next, those of the great oblique muscle; then those of the levator palpebræ superioris, varying, according to their insertions, the manner of holding the knife. The eyeball is afterward detached, and the four straight muscles, and optic nerve, divided with a pair of scissors.

This way of operating, founded upon anatomical principles, seems at first glimpse to offer a method, in which, as Louis remarks, each stroke of the instrument is guided by the knowledge of the parts. But, it is to be noticed, that these parts, being altered by disease, most commonly do not present the same structure and relations, which they do in the natural state; and that the flattened, lacerated, destroyed muscles, on their being confused with the eye itself, cannot serve, as in lithotomy, for the foundation of any precept relative to the operation. Besides, why use both the knife and scissors? The latter instrument is obviously useless, though Louis seems to think the operation cannot be done without it. The inclination of the outer side of the orbit will

always allow a bistoury to be carried to the bottom of this cavity, so as to divide from above downwards, the optic nerve, and muscular attachments.

Guided by the above principles, Desault, after having practised, and taught the method of Louis, returned to Heister's advice, who directs only a bistoury to be employed. To have an exact idea of the mode of operating, which is always easy and simple with this one instrument, we must suppose the carcinoma to be in three different states. 1. When the tumour hardly projects out of the orbit, so that the eyelids are free. 2. When it is much larger, projects considerably forward, and pushes in this direction the healthy eyelids, which are in contact with it, together with a portion of the conjunctiva, which invests them, and is now detached from them. 3. When, in a much more advanced period, the eyelids participate in the cancerous state. In the first case, the eyelids must be separated from the eye, by cutting through the conjunctiva, where it turns to be reflected over the globe of the eye. In the second instance, the eyelids and conjunctiva, which are in contact with the diseased eye, must be dissected from it. In the third, these parts must be cut away, together with the eye. (*Œuvres Chir. de Desault, T. 2.*)

After the above observations, and the additional information on the subject contained in the 1st vol. of the 4th Edition of the *First Lines of the Practice of Surgery*, I shall conclude this article with a few brief directions.

When the eyeball is exceedingly enlarged, it is necessary to divide the eyelids at the external angle, in order to facilitate the operation. The surgeon can in general operate most conveniently when he employs a common dissecting knife, and when his patient is lying down with his face exposed to a good light. In cutting out a diseased eye, it is necessary to draw the part forwards, regularly as its surrounding attachments are divided, in order that its connexions, which are still more deeply situated, may be reached with the knife. This object cannot be very well accomplished with the fingers, or forceps, and, therefore, most surgical writers recommend us, either to introduce a ligature through the front of the tumour, (see *Travers, Synopsis, p. 308.*) or to employ a hook, for the purpose of drawing the part in any direction, during the operation, which, the necessary proceedings may require. When the eyelids are diseased, they must be removed; but, if prudence sanctions their being preserved, this is an immense advantage. The eye must not be drawn out too forcibly, before the optic nerve is divided, and care must be taken not to penetrate any of the foramina, or thin parts of the orbit, with the point of the knife, for fear of injuring the brain. Great care should also be taken to leave no diseased parts behind, in the orbit. The hemorrhage may be stopped by filling the orbit with scraped

lint, and applying a compress and bandage. It is constantly advisable to remove the lachrymal gland, as this part seems to be particularly apt to be the source of such inveterate fungous diseases, as too often follow the operation.

Mr. Travers, with a straight double-edged knife, freely divides the conjunctiva and oblique muscles, so as to separate the eyeball and lachrymal gland from the base of the orbit. Drawing the eye then gently forwards with the ligature, he introduces a double-edged knife, "curved breadthwise" at the temporal commissure of the lids, for the purpose of dividing the muscles, vessels, and nerves, by which the globe remains attached. The hemorrhage he represses with a small bit of fine sponge put into the orbit, and a light compress, applied over the eyelids, and supported with a bandage. The sponge, he says, should not be suffered to remain longer than the following day, when a soft poultice in a muslin bag may be substituted for the compress. He approves of giving an opiate at bed-time, and joins the late Mr. Ware in condemning the practice of cramming the orbit with lint, or charpie, and leaving it to be discharged by suppuration. (*Synopsis of the Diseases of the Eye*, p. 308.)

For a few days after the operation, antiphlogistic treatment is proper. Sometimes fungous granulations continually form in the orbit, notwithstanding they are repeatedly destroyed; and sometimes the disease in the orbit extends even to the brain, and produces fatal consequences. When malignant fungous excrescences grow from the cornea alone, it is clearly unnecessary to extirpate the whole eyeball.

For information relating to the subjects of this article, consult particularly *Mémoire sur plusieurs Maladies du Globe de l'Œil; ou l'on examine particulièrement les cas qui exigent l'extirpation de cet organe, et la Mé-*

thode d'y proceder; par M. Louis, in Mém. de l'Acad. de Chirurgie, Tom. 13, p. 262, Edit. in 12mo: C. F. Kulichmeid, Programma de oculo ulcere canceroso laborante feliciter extirpato, &c. Jenæ. 1748. J. G. G. Voit, Oculi Humani Anatomia et Pathologia ejus demque in statu morboſo Extirpatio, 8vo. Norimb. 1810. Bertrandi, Traité des Opérations de Chirurgie, p. 519, Edit. 1784, Paris. Sabatier, de la Médecine Opératoire, Tom. 3, p. 54, Edit. 1. Richter, Anfangsgr. der Wundars. B. 3, p. 415, Gott. 1795. Mémoire sur l'Extirpation de l'Œil Carcinomateux in Œuvres Chir. de Desault par Bichat, T. 2, p. 102. Richerand, Nosographie Chir. T. 2, p. 103, &c. Edit. 2. Ware, in Trans. of the Medical Society of London, Vol. 1, part 1, p. 140, &c. Lassus, Pathologie Chir. T. 1, p. 450, Edit. 1809. Wardrop on Fungus Hæmatodes, p. 93, &c. Scarpa on the principal Diseases of the Eye, chap. 21. Ed. 2, transl. by Briggs, 8vo. Lond. 1818. B. Travers, A. Synopsis of the Diseases of the Eye, Sec. 4, 8vo. Lond. 1820.

EYE, DISEASES OF. See *Amaurosis; Cataract; Cornea; Encanthis; Exophthalmia; Fungus Hæmatodes; Gutta Serena; Hemeralopia; Iris; Hydrophthalmia; Hyppopium; Leucoma; Nyctalopia; Ophthalmia; Pterygium; Pupil, Closure of; Staphyloma, &c. &c.*

EYELIDS, DISEASES OF. See *Ectropium; Lagophthalmus; Hordeolum; Ptoſis; Trichiasis; and Tumours Encysted.* In the examination of the interior of the upper eyelid, a modern very convenient plan is now pursued, which is to evert the part over a probe, which is to be placed just across the upper edge of the cartilage of the tarsus, which is then to be suddenly inclined outwards, when the whole inner surface of the lid will be exposed, the part continuing in this everted state until replaced by the surgeon.

F.

FEVERS, SURGICAL. Under this head may be comprehended two species of fever, viz. the *inflammatory* and the *hectic*, which are particularly interesting to surgeons, because frequently attendant on surgical disorders.

In treating of inflammation, I have mentioned, that a febrile disturbance of the constitution is attendant on every considerable inflammation. In the present article, some account will be offered of the particulars of this disorder.

The fever about to be described is known and distinguished by several names; some calling it *inflammatory*; some *symptomatic*; and others *sympathetic*. It is sometimes idiopathic; that is to say, it occasionally originates at the same time with the local inflammation, and from the same causes. (*Burns.*) In other instances, and indeed we may say

in all ordinary surgical cases, it is symptomatic; or, in other words, it is produced, not directly by the causes which originally produced the inflammation, but in consequence of the sympathy of the whole constitution with the disturbed state of a part.

The idiopathic inflammatory fever is said to be always preceded by chilliness. The symptomatic, or sympathetic inflammatory fever, sometimes takes place so quickly, in consequence of the violence of the exciting cause, or of the local inflammation, that no preceding coldness is observable. If, however the local inflammation be more slowly induced, and consequently operate more gradually on the system, then the coldness is evidently perceived. The symptomatic fever, induced by scalding, or burning a part, is quickly produced, and we have very little time to attend to the earliest period of its formation. On the other hand, the sympto-

matic fever, induced by wounds, is excited more slowly, and the period of its formation is longer. This fever is not produced, when the inflammation only affects parts in a slight degree; but it makes its appearance, if the local inflammation be considerable, or if it affect very sensible parts. (*Burns.*)

The degree, in which this fever is excited does not altogether depend upon the absolute quantity or violence of the inflammation; but in a great measure upon the degree of the local inflammatory action, compared with the natural power and action of the part affected. Parts in which the action is naturally low, are extremely painful when inflamed, and the system sympathizes greatly with them. Hence, the constitution is very much affected when tendons, bones, or ligaments, are the parts inflamed. Severe inflammation of a large joint, every one knows, is apt to excite the most alarming, and even fatal derangement of the system. When very sensible parts are inflamed, as for instance the eye, the symptomatic fever is generally more considerable than it would be were it to arise from an equal quantity and degree of inflammation in a less sensible organ.

In common parts, as muscles, cellular membrane, skin, &c. the symptoms will be acute; the pulse strong and full, and the more so if the inflammation be near the heart; but, perhaps not so quick as when the part is far from it. The stomach will sympathize less, and the blood will be pushed farther into the small vessels. (*Hunter.*)

If the inflammation be in tendinous, ligamentous, or bony parts, the symptoms will be less acute, the stomach will sympathize more, the pulse will not be so full, but perhaps quicker; there will be more irritability, and the blood not being propelled so well into small vessels, it will forsake the skin. (*Hunter.*)

It seems to be a material circumstance, whether the inflammation is in the upper, or lower extremity; that is, far from, or near the heart, for the symptoms are more violent, the constitution more affected, and the power of resolution less, when the part inflamed is far from the source of the circulation, than when near it, even when the parts are similar, both in texture and use. (*Hunter.*)

If the heart, or lungs, are inflamed, either immediately, or affected secondarily, by sympathy, the disease has more violent effects upon the constitution than the same quantity of inflammation would have if the part affected were not a vital one, or one with which the vital parts did not sympathize. If the part be such as the vital ones readily sympathize with, then the sympathetic action of the latter will affect the constitution, as in an inflammation of the testicle. (*Hunter.*) In such cases, the pulse is much quicker and smaller, and the blood is more sily than if the inflammation were in a common part, such as muscle, cellular membrane, and skin. (*Hunter.*)

When the stomach is inflamed, the pa-

tient feels an oppression and dejection through all the stages of the inflammation; the pulse is generally low and quick, and the pain obtuse, strong, and oppressing; such as the patient can hardly bear. If the intestines are much affected, the same symptoms take place, especially if the inflammation be in the upper part of the canal; but if only the colon be affected, the patient is more roused, and the pulse is fuller than when the stomach alone is inflamed. When the uterus is inflamed, the pulse is extremely quick and low. When the inflammation is either in the intestines, testicle, or uterus, the stomach generally sympathizes. In inflammation of the brain, the pulse varies more than in the same affection of any other part; and perhaps we must, in this instance, form a judgment of the complaint, more from other symptoms than the pulse. (*Hunter.*)

When inflammation is situated in a part, not very essential to life, and occasions the general affection of the system, called inflammatory fever, the pulse is fuller and stronger than common, and the blood is pushed farther into the extreme arteries than when the inflammation is in a vital part. The patient, after many occasional rigours, is at first rather roused. The pulse is as above described, when the constitution is strong and not irritable; but if this be extremely irritable and weak, as in many women who lead sedentary lives, the pulse may be quick, hard, and small, at the commencement of the inflammation, just as if vital parts were concerned. The blood may also be sily; but it will be loose and flat on the surface. (*Hunter.*)

We may set down the ordinary symptoms of the inflammatory fever, occurring in consequence of local inflammation in common parts and in a healthy habit, as follows: The pulse is frequent, full, and strong; all the secretions are diminished; the patient is vigilant and restless; the perspiration is obstructed, and the skin is hot and dry; the urine is high-coloured, and small in quantity; the mouth is parched, and the tongue furred; an oppressive thirst is experienced; with disturbance of the nervous system; loss of appetite and sleep; and in some cases, delirium.

TREATMENT OF INFLAMMATORY FEVER.

Upon this part of the subject very little is to be said; for as in almost every instance the febrile disturbance of the system is produced, and entirely kept up by the local inflammation, it must be evident, that the means employed for diminishing the exciting cause, are also the best for abating the constitutional effects. Hence it very seldom happens that any particular measures are adopted expressly for the fever itself; as this affection is sure to subside in proportion as the local inflammation is lessened or resolved. But when the febrile disturbance is considerable, and the inflammation itself is also considerable, the agitated state of the system may have in its turn a share in keep-

ing up, and even increasing the local affection, and should be quieted as much as possible. However, in these very instances, in all probability we should be led to a more rigorous adoption of the antiphlogistic plan of treatment, by an abstract consideration of the state of the local inflammation itself, without any reference to that of the constitution. Indeed the increased action of the heart and arteries, and the suppression of the secretions, require the employment of antiphlogistic means, and antimonials. the very same things which are indicated for the resolution of the local inflammation itself. Bleeding, purging, cold drinks, low diet; the exhibition of the antimonium tartarizatum, James's powder, or the common antimonial powder; and bathing the feet and body in warm water, are measures which have the greatest efficacy in tranquillizing the constitutional disturbance implied by the term inflammatory fever. But I think it right to repeat, that it is hardly ever necessary to have recourse to such an evacuation as general bleeding, merely on account of the fever; as this is only an effect which invariably subsides in proportion as the local cause is diminished.

As Dr. Thomson has remarked, "the inflammatory fever, succeeding to external injuries, or to surgical operations, undergoes a kind of natural crisis by the appearance of suppuration. In these instances therefore, unless when the patient is strong and in full health, when the disease is seated in an organ of much importance to life, or is in danger of spreading, as is the case in all inflammations of the membranes lining the three great cavities of the body, the lancet ought to be used with caution. For we may, by too free a detraction of blood, produce a sudden sinking of the powers of life, and convert the existing constitutional symptoms into fever of a different type or character. But in all cases of inflammation, in which any doubt arises with regard to the farther general detraction of blood, it may, I believe, be laid down as a general rule, that it is safer to employ local than general blood-letting." (*Lectures on Inflammation*, p. 170.)

HECTIC FEVER.

The *sympathetic*, or *symptomatic* fever, already described, is an *immediate* affection of the constitution, in consequence of some local disorder; hectic fever is a *remote* effect. When hectic fever is a consequence of local disease, it has commonly been preceded by inflammation and suppuration; but there is an inability to produce granulation and cicatrization: and the cure, of course, cannot be accomplished. The constitution may now be said to be oppressed with a local disease, or irritation, from which it cannot deliver itself.

A distinction should be made between hectic fever, arising entirely from a local complaint in a good constitution, which is only disturbed by too great an irritation, and hectic fever, arising principally from the

badness of the constitution; which does not dispose the parts to heal. In the first species, it is only necessary to remove the part (if removeable,) and then all will do well; but in the second, nothing is gained by a removal of the part, unless the wound, made in the operation, is much less, and more easily put into a local method of cure; by reason of which, the constitution sinks less, under this state and the operation together, than under the former disease. Here the nicest discrimination is requisite. (*Hunter*.)

Owing to a variety of circumstances, hectic fever comes on at very different periods after the inflammation, and commencement of suppuration. Some constitutions having less powers of resistance than others, must more easily fall into this state.

Hectic fever takes its rise from a variety of causes, which have been divided into two species, with regard to diseased parts; viz. parts called vital, and others not of this nature. Many of the causes of hectic fever, arising from diseases of the vital parts, would not produce this constitutional affection, if they were in any other part of the body; such, for instance, is the formation of tumours, either in, or so as to press upon, a vital part, or one whose functions are immediately connected with life. Scirrhi in the stomach; and mesenteric glands; diseased lungs, liver, &c. very soon produce hectic fever.

When hectic fever arises from a disease of a part that is not vital, it commences sooner or later, according as it is in the power of the part to heal, or continue the disease. If the part be far from the source of the circulation, the fever will come on sooner, with the same quantity of disease. When the disease is in parts which are not vital, and excites hectic fever, it is generally in situations where so much mischief happens, as to affect the constitution, and where the powers of healing are little. This is the case with diseases of many of the joints. We must also include parts which have a tendency to such specific diseases, as are not readily cured in any situation.

Although hectic fever commonly arises from some incurable local disease of a vital part, or of an extensive disease of a common part, yet it is possible for it to be an original disease in the constitution, without any local cause whatever, that we know of.

Hectic is a slow mode of dissolution: the general symptoms are those of a low, or slow fever, attended with weakness. But there is rather weak action, than real weakness; for upon the removal of the hectic cause, the action of strength is immediately produced, and every natural function is re-established, however much it may have been previously impaired.

The particular symptoms are debility; a small, quick, and sharp pulse; the blood forsakes the skin; loss of appetite; frequently, a rejection of all aliment from the stomach; wasting; a great readiness to be thrown into sweats; spontaneous perspirations, when the patient is in bed; pale-co-

loured, and very copious urine; and often a constitutional purging.

Hectic fever has been imputed to the absorption of pus into the circulation; but no doubt, much exaggeration has prevailed in the doctrine, which ascribes to this cause many of the bad symptoms, frequently attacking persons who have sores. When suppuration takes place in particular parts, especially vital ones, hectic fever almost constantly arises. It also attends many inflammations before suppuration has actually happened, as in cases of white swelling of the large joints. The same quantity and species of inflammation and suppuration in any of the fleshy parts, especially such as are near the source of the circulation, have in general no such effect. Hence, in the first instances, the fever is only an effect on the system, produced by a local complaint, that has a peculiar property.

The constitution sympathizes more readily with diseases of vital organs, than with those of any other parts; their diseases are also in general more difficult of cure, than the same affections of parts, which are not vital. All diseases of bones, ligaments, and tendons, affect the constitution more readily, than those of muscles, skin, cellular membrane, &c.

When the disease is in vital parts, and is such as not to kill, by its first constitutional effects, the system then becomes teased with a complaint, which is disturbing the *necessary actions of health*. In the large joints, a disease continues to harass the constitution, by attacking parts which have no power, or rather, no disposition to produce salutary inflammation and suppuration. Thus, the system is also irritated by the existence of an incurable disease. Such is the theory of the cause of hectic fever.

If the absorption of matter always produced the symptoms above described, how could any patient who has a large sore, possibly escape hectic; for there is no reason to suppose, that one sore can absorb more readily than another. If absorbed matter occasioned such violent effects as have been commonly ascribed to it, why does not venereal matter do the same? We often know that absorption is going on, by the progress of buboes. A large one, just on the point of bursting, has been known to be absorbed, in consequence of a few days' sea-sickness. The person continued at sea for four and twenty days afterward; yet no hectic symptoms followed, but only the specific constitutional effects, which were of a very different description.

When the cavities of veins are inflamed, matter is sometimes formed within these vessels, and cannot fail to get into the circulation; yet, hectic symptoms do not arise. Also very large collections of matter, produced without visible inflammation, as many abscesses of the scrophulous kind, are wholly absorbed, in a very short time, but no bad symptoms are the consequence. (Hunter.)

We may conclude, therefore, that the ab-

sorption of pus has no share in occasioning hectic fever. Many arguments might be adduced to expose the absurdity of the doctrine; but, here it will be sufficient to refer the reader to what Mr. Hunter has said farther on the subject, in his work on inflammation.

It is much more probable, that hectic fever arises from the effect, which the irritation of a vital organ, or other parts, such as joints, has on the constitution, when either incurable in themselves, or are so for a time to the constitution. (Hunter.)

TREATMENT OF HECTIC FEVER.

There is no method of curing the consequences above related. All relief must depend on the cure of the cause, (viz. the local complaint) or on its removal.

Tonic medicines have been recommended, on account of the evident existence of great debility. Antiseptics have also been given, in consequence of the idea that, when pus is absorbed, it makes the blood disposed to putrefy. For these reasons, bark and wine have been exhibited. In most cases, bark will only assist in supporting the constitution. Until the cause is removed, however, there seems no prospect of curing a disorder of the constitution. It is true, tonic medicines may make the system less susceptible of the disease, and also contribute to diminish the cause itself, by disposing the local complaints to heal. When, however, the hectic fever arises from a specific disease, such as the venereal, though bark may enable the constitution to bear the local affection better, than it otherwise could do, yet, this medicine can never remove the syphilitic mischief. (Hunter.)

No medicine, not even bark itself, has any direct power of communicating strength to the human constitution. All that can be done, in the treatment of hectic fever, when it is thought inexpedient, or impracticable, to remove the morbid part, is to combat particular symptoms, and to promote digestion. It is by bringing about the latter object that bark in these cases is useful. The infusion of cinchona being more likely to agree with the stomach, than the decoction, or powder, should generally be preferred. Nourishing food, easy of digestion, should be frequently taken, in small quantities at a time. Nothing is more prejudicial to a weak constitution, than overloading the stomach. Wine may also be given, but not too freely, and, not at all, if it should create heartburn, as it sometimes does in hectic patients. Madeira is less apt, than port, to have this disagreeable effect. In these cases, it is likewise often found useful to administer gentle cordial aromatic draughts. But, of all medicines, opium is perhaps the most valuable to those who are afflicted with hectic fever; it alleviates pain, procures sleep, and checks the diarrhoea, which so frequently contributes to hasten the patient's dissolution.

When the local complaint, connected with

this fever, is totally incurable, it must, if possible, be removed by a manual operation. Thus, when a diseased joint keeps up hectic fever, and seems to present no hope of cure, amputation must be performed. But, when the local disease is attended with a chance of cure, provided the state of the constitution were improved, the surgeon is to endeavour to support the patient's strength. Great discretion, however, must be exercised, in deciding how long it is safe to oppose the influence of an obstinate local disease over the system, by the power of medicine; for, although some patients, in an abject state of weakness, have been restored to health by a removal of the morbid part, many have been suffered to sink so low, that no future treatment could save them from the grave. Clemency in the practice of surgery does not consist so much in delaying strong and vigorous measures, as in boldly deciding to put them in execution, as soon as they are indicated.

When hectic fever arises from local diseases in parts, which the constitution can bear the removal of, the morbid part should be taken away, if it cannot be cured, consistently with the advice already given. When the disease arises from some incurable disease in an extremity, and amputation is performed, all the abovementioned symptoms generally cease, almost immediately after the removal of the limb: Thus, a hectic pulse, at one hundred and twenty, has been known to sink to ninety in a few hours after the removal of the hectic cause. Persons have been known to sleep soundly the first night afterward, who had not slept tolerably for several preceding weeks. Cold sweats have stopped immediately, as well as those called colliquative. A purging has immediately ceased, and the urine begun to drop its sediment. (*Hunter.*)

FICATIO, or FICUS. (a fig.) A tubercle about the anus, or pudenda, resembling a fig.

FINGERS, ABSCESSSES OF. See *Whitlow*.

FINGERS, Amputation of. See *Amputation*.

FINGERS, Necrosis of. In these cases, the surgeon is to endeavour to extract the exfoliating portions of bone, immediately they become loose. For this purpose he is justified in making such incisions, as will enable him to fulfil the object in view. Until the process of exfoliation is sufficiently advanced, he can do little more, than apply simple dressings, and keep the part in a clean quiet state.

When the separation of the dead pieces of bone will certainly destroy the utility of the finger, and convert the part into an inconvenient, stiff appendage to the hand; or, when the patient's health is severely impaired by the irritation of the disease, the termination of which cannot be expected, within a moderate space of time, amputation is proper. It is a truth, however, that many fingers are amputated, which might be preserved, and surgeons ought to consider well, before presuming to remove parts,

which, when curable, may become of the greatest consequence, in regard to the perfection of the hand. The bread of many persons, it is well known, depends on the unutilized state of certain fingers. These remarks are offered, because I have seen several surgeons, fond of seizing every opportunity of cutting their fellow-creatures, remove fingers, which might have been usefully saved, either by allotting a little more time for the exfoliation or by making incisions, and cutting out the dead piece of bone.

FINGERS, Dislocations of. See *Dislocation*.

FINGERS, Fractures of. See *Fracture*.

FINGERS SUPERNUMERARY. The instances of children born with a smaller number of fingers, than natural, are more rare, than cases in which the number is greater, than usual. Of the latter malformation, examples were noticed in times of great antiquity. Thus, in the 1st Book of Chronicles is the following notice of such an occurrence: "There was war at Gath, where was a man of great stature, whose fingers and toes were four and twenty, six on each hand, and six on each foot." (*Chap. xx. Verse 6.*) Ann Boleyn, so celebrated for her beauty, and her misfortunes, had six fingers on her right hand. Pliny, the naturalist, speaks of two sisters, who had six fingers upon each of their hands. In the Memoirs of the Royal Academy of Sciences for 1743, is the account of a child, which was shown at one of the meetings, and had six toes on each foot, and the same number of fingers on each hand. In each foot, there was six metatarsal bones, and the left hand an equal number of metacarpal bones, but in the right hand, there were only five, the outer one of which had two articular surfaces, one for the little, and the other for the supernumerary finger. In the Copenhagen Transactions, T. Bartholine has inserted the description of a very curious skeleton: on the right hand, there were seven fingers; on the left six; and besides these circumstances, the thumb was double. On the right foot, there were eight toes; on the left, nine; the right metatarsus consisting of six bones; the left, of seven. Saviard speaks of a still more curious case: he saw a new-born infant at the Hôtel Dieu at Paris, which had ten fingers on each hand, and ten toes on each foot: the phalanges seemed, as if they were all in a broken imperfect state. (*Obs. de Chir.*) The example of the greatest number of fingers and toes is recorded by Voigt; including the thumb, there were thirteen fingers on each hand, and twelve toes on each foot. (*Mag. für das neueste der Naturkunde*, 3 B. p. 174.) Individuals are occasionally born with two thumbs, on the same hand. (*Panarolus. Perilec. 3, Obs. Obs. 4-8.*)

Since allowing the redundant number of fingers to remain would keep up deformity, and create future inconvenience, the surgeon is called upon to amputate them. The redundant fingers are sometimes with, sometimes without a nail; are seldom more nu-

merous than one upon each hand; are generally situated just on the outside of the little fingers; and, as far as my observation extends, are incapable of motion, in consequence of not being furnished, like the rest of the fingers, with muscles. The phalanges are also mostly imperfectly formed, or deficient. The best plan is to cut off supernumerary fingers with a scalpel, at the place where they are united to the other part of the hand. The operation should be performed, while the patient is in the infant state, that is to say, before the superfluous parts have acquired much size, and while the object can be accomplished with the least pain. The incisions ought to be made, so as to form a wound with edges, which will admit of being brought together with strips of adhesive plaster. As soon as the dressings are applied, the hemorrhage will almost always cease, without a ligature.

FISSURE, (from *findo*, to cleave asunder.) A very fine crack in a bone is so called.

FISTULA, in surgery, strictly means a sore, which has a narrow orifice, runs very deeply, is callous, and has no disposition to heal. The name is evidently taken from the similitude, which the long cavity of such an ulcer has to that of a pipe or reed. A fistula commonly leads to the situation of some disease keeping up suppuration; and from which place the matter cannot readily escape. No technical term has been more misapplied than this; and no misinterpretation of a word has had worse influence in practice, than that of the present one. Many simple, healthy abscesses, with small openings, have too often been called *fistulous*; and, being considered as in a callous state, the treatment pursued has in reality at last rendered them so, and been the only reason of their not having healed.

FISTULA IN ANO. See *Anus*.

FISTULA LACHRYMALIS. In correct language, this term can be applied only to one case, viz. that in which there is an ulcerated opening in the lachrymal sac, unattended with any tendency to heal, and from which opening a quantity of puriform fluid is from time to time discharged, especially when the lachrymal sac is compressed. Such has been the confusion, however, prevailing respecting the nature of the diseases of the lachrymal passages, and so great has been the force of ancient custom, that down to the present time, the generality of British, as well as foreign surgeons, imply by the expression, *fistula lachrymalis*, several forms of disease, totally different from each other, and to only one of which the name is at all applicable. In order not to assist in perpetuating this absurd and erroneous plan, from which nothing but mistakes and ignorance can result, I shall follow the example, pointed out by Beer, Schmidt, and our countryman, Mr. McKenzie, and consider the various forms of disease, to which the lachrymal passages are subject, not under the head of *fistula lachrymalis*, but under the more sensible title, *Lachrymal Organs, Diseases of the*.

***FISTULÆ IN PERINÆO**. As Mr. A. Cooper has justly observed, incisions in the urethra generally heal with great facility; a fact, amply proved by the common result of the lateral operation; but, when apertures are formed in the urethra, either from diseased states of the constitution and the part together, or of the latter alone, and when they are accompanied with any considerable destruction of the sides of the urethra, and of the corpus spongiosum, they are mostly very difficult of cure. (*Surgical Essays, Part 2, p. 211.*)

When the methods recommended for the removal of strictures (See *Urethra, Strictures of*) have not been attempted, or not succeeded, nature endeavours to relieve herself by making a new passage for the urine, which, although it often prevents immediate death, yet, if not remedied, is productive of much inconvenience and misery to the patient through life. The mode, by which nature endeavours to procure relief, is by ulceration on the inside of that part of the urethra which is enlarged, and situated between the stricture and the bladder. Thus the urine becomes applied to a new surface; irritating the part, and occasioning the formation of an abscess, into which the urine has access; and when the matter is discharged, be it by nature, or by art, the urine passes through the aperture, and generally continues to do so, whilst the stricture remains. (*A. Cooper, Surgical Essays, Part 2, p. 212.*)

The ulceration commonly begins near, or close to the stricture, although the stricture may be at a considerable distance from the bladder. The stricture is often included in the ulceration, by which means it is removed; but, unluckily, this does not constantly happen. The ulceration is always on the side of the urethra, next to the external surface.

The internal membrane and substance of the urethra having ulcerated, the urine readily gets into the loose cellular membrane of the scrotum and penis, and diffuses itself all over those parts; and as this fluid is very irritating to them, they inflame and swell. The presence of the urine prevents the adhesive inflammation from taking place; it becomes the cause of suppuration wherever it is diffused, and the irritation is often so great that it produces mortification, first in all the cellular membrane, and afterward in several parts of the skin; all of which, if the patient live, slough away, making a free communication between the urethra and external surface, and producing what are termed *fistule in perinæo*, though it is plain enough to every surgeon, who knows the correct meaning of the word *fistula*, that a recent opening, produced in the perineum by ulceration or sloughing, ought not to be called a fistula, immediately it is formed, and at least, not until it has acquired some of the characters, specified in our explanation of the term *fistula*.

According to Mr. Hunter, when ulceration takes place further back, than the por-

tion of the urethra, between the glans penis and membranous part of the canal, the abscess is generally more circumscribed.

The urine sometimes insinuates itself into the corpus spongiosum urethræ, and is immediately diffused through the whole, even to the glans penis, so as to produce a mortification of all those parts. A fatal instance of this kind is reported by Mr. C. Bell. (*Surgical Obs. Vol. 1. p. 98.*)

Although the ulceration of the urethra may be in the perinæum, yet the urine generally passes easily forwards into the scrotum, which contains the loosest cellular substance in the body; and there is always a hardness, extending along the perinæum to the swelled scrotum, in the track of the pus. (*Hunter.*)

Mr. A. Cooper is of opinion, that, as soon as the abscesses, which are the forerunners of the fistulæ, can be plainly felt to contain a fluid, it is the best practice to open them with a lancet. The extensive destruction of parts by ulceration, will thus be prevented; the place not unfrequently then heals up expeditiously without any fistulous orifice being left, and a tendency to those dangerous extravasations of urine is also prevented, which, if the abscesses are not opened early, often prove destructive to life. (*A. Cooper, Vol. cit. p. 212.*)

Ulceration can only be prevented by destroying the stricture; but when the urine is diffused in the cellular membrane, the removal of the stricture will generally be too late to prevent all the mischief, although it will be necessary for the complete cure. Therefore, an attempt should be made to pass a bougie, for perhaps the stricture may have been destroyed by the ulceration, so as to allow this instrument to be introduced. When this is the case, bougies must be almost constantly used, in order to procure as free a passage as possible. In these cases, Mr. A. Cooper expresses a preference to metallic bougies, the size of which is to be gradually increased, until their diameter exceeds the natural diameter of the passage. In some instances, however, he says, that it will be necessary to introduce a pewter catheter, of large size, and to allow it to remain in the bladder, so as at once to act upon the stricture, and hinder the urine from passing through the preternatural opening. In this manner a permanent cure may often be effected. Although this experienced surgeon agrees with most surgeons of the present day, respecting the general expediency of employing caustic for the removal of a stricture, under the preceding circumstances, yet he admits, that instances do present themselves, in which, from long neglect, the urethra, and the parts, surrounding the stricture, are so altered in structure, that no instrument can be passed through the obstruction, without danger, and where the slower action of caustic is safer, than the use of a metallic bougie. (*Surgical Essays, Part 2, p. 213.*) The experience of modern surgeons tends to prove, however, that there are some cases which

form exceptions to the plan of employing bougies, or catheters, though a fistulous opening may have occurred in the passage. These cases are the examples, in which the apertures in the urethra are the consequence of ulceration and abscess, unaccompanied by stricture, and taking place in a bad constitution, and perhaps only preceded by a slight discharge from the urethra. Here bougies would increase the tendency to ulceration, and aggravate the local and constitutional irritation. (*A. Cooper, p. 216.*)

While we are attempting to cure the stricture, antiphlogistic measures, particularly bleeding, are to be adopted. The parts should be exposed to the steam of hot water; the warm bath made use of; opium and turpentine medicines given by the mouth, and in clysters; with a view of diminishing any spasmodic affection. But, as Mr. Hunter observes, all these proceedings are often insufficient; and, therefore, an immediate effort must be made, both to unload the bladder, and to prevent the further effusion of urine, by making an opening in the urethra, somewhere beyond the stricture, but the nearer to it the better.

Introduce a director, or some such instrument, into the urethra, as far as the stricture, and make the end of it as prominent as possible, so as to be felt; which, indeed, is often impossible. If it can be felt, it must be cut upon, and the incision carried on a little farther, towards the bladder, or anus, so as to open the urethra beyond the stricture. This will both allow the urine to escape, and destroy the stricture. If the instrument cannot be felt, at first, by the finger, we must cut down towards it; and, on afterward feeling it, proceed as above.

When the stricture is opposite the scrotum, as the opening cannot be made in this situation, it must be made in the perinæum, in which case there can be no direction given by an instrument, as one cannot pass sufficiently far, and the only guide is our anatomical knowledge. The opening being made, proceed as directed in the cure of a false passage. (*See Urethra, False passage of.*) In whichever way the operation is done, a bougie, or a catheter, which is better, must afterward be introduced, and the wound healed over it.

When the inflammation, from the extravasation of urine is attended with suppuration and mortification, the parts must be freely scarified, in order to give vent both to the urine and pus. When there is sloughing, the incisions should be made in the mortified parts.

Sometimes, when the urethra is ulcerated, and the cellular membrane of the penis and prepuce is so much distended, as to produce a phymosis, it is impossible to find the orifice of the urethra.

Frequently the new passages for the urine do not heal, on account of the stricture not being removed: and even when this has been cured, they often will not heal, but become truly fistulous, and produce fresh inflammations and suppurations, which often

burst by distinct openings. Such new abscesses and openings often form, in consequence of the former ones having become too small, before the obstruction in the urethra is removed.

Such diseases sometimes bring on intermittent disorders, which do not yield to bark; but cease as soon as the fistulæ and disease of the urethra have been cured.

In order to cure fistulæ in perinæo, untended with the above described urgent symptoms, the urethra must be rendered as free as possible, and this alone is often enough; for, the urine finding a ready passage forwards, is not forced into the internal mouth of the fistulæ, so that these heal up. The cure of the strictures, however, is not always sufficient, and the following operation becomes indispensable.

The sinuses are to be laid open in the same manner as other sinuses, which have no disposition to heal. In doing this, as little as possible of the sound part of the urethra must be opened. Hence, the surgeon must direct himself to the inner orifice of the fistulæ, by means of a staff, introduced (if possible) into the bladder, and a probe passed into one of the fistulous passages. The probe should be first bent, that it may more readily follow the turns of the fistulæ. When it can be made to meet the staff, so much the better; for then the operator can just cut only what is necessary.

When the fistula is so straight, as to admit of a director being introduced, this instrument is the best. When neither the probe nor the director, can be made to pass as far as the staff, we must open the sinuses as far as the first instrument goes, and then search for the continuation of the passage, for the purpose of laying it open. The difficulties of this dissection, however, in the thickened, diseased state of the parts in the scrotum and perinæum, are such as can only be duly appreciated by a man, who has either made the attempt himself, or seen it made by others. I have myself seen one of the first anatomists in London fail in two instances to trace the continuation of the urethra, and baffled in the endeavour, therefore, to pass an instrument from the orifice of that passage into the bladder. The difficulty and confusion, arising from the hardened, enlarged state of the parts, which are to be cut, have been well depicted by Mr. C. Bell. (*Surgical Obs. Vol. 1, p. 129.*)

Having divided the fistulæ as far as their termination in the urethra, a catheter should be introduced, and worn, at first, almost constantly. This is better than a bougie, which must be frequently withdrawn to allow the patient to make water, and it often could not be introduced again without being entangled in the wounds.

In many cases, the employment of the catheter should not be continued after a certain period. At first, it often assists the cure; but, in the end, it may obstruct the healing, by acting at the bottom of the wound, as an extraneous body.

Hence, when the sores become stationary, let the catheter be withdrawn, and introduced only occasionally. And even after the sores are well, it will be prudent to use the bougie, in order to determine whether the passage is free from disease.

When fistulæ in perinæo have been laid open, the wounds are to be at first dressed down to the bottom as much as possible, which will prevent the reunion of the parts first dressed, and make the granulations shoot from the bottom, so as to consolidate the whole by one bond of union. (*Hunter on the Venereal Disease, Edit. 2.*) Additional observations upon this subject, and, in particular, the opinions of Desault, will be found in the article *Urinary Abscesses and Fistulæ*. Mr A. Cooper's practice in cases, where a considerable portion of the urethra has been destroyed, will be hereafter noticed. (See *Urethra*.)

FISTULA, SALIVARY. (See *Parotid Duct*.)

FLUCTUATION. (from *flucto*, to float.) the perceptible motion communicated to any collection of purulent matter, or other kind of fluid, by applying the fingers to the surface of the tumour, and pressing with them alternately, in such a manner, that the fingers of one hand are to be employed in pressing, or rather in briskly tapping upon the part, while those of the other hand remain lightly placed on another side of the swelling. When the ends of one set of fingers are thus delicately applied, and the surgeon taps, or makes repeated pressure with the fingers of the other hand, the impulse, given to the fluid, is immediately perceptible to him, and the sensation, thus received, is one of the principal symptoms, by which practitioners are enabled to discover the presence of fluid in a great variety of cases. Great skill in ascertaining by the touch the presence of fluid in parts, or being endued with the *tactus eruditus*, as it is termed, distinguishes the man of experience as remarkably, perhaps, as any quality that can be specified.

When the collection of fluid is very deeply situated, the fluctuation is frequently exceedingly obscure, and sometimes not at all distinguishable. In this circumstance, the presence of the fluid is to be ascertained by the consideration of other symptoms. For example, in cases of hydrops pectoris and empyema, surgeons do not expect to feel the undulation of the fluid in the thorax with their fingers; they consider the patient's difficulty of breathing, the uneasiness attending his lying upon one particular side, the oedema of the parietes of the chest, the dropsical affection of other parts, the more raised and arched position of the ribs on the affected side, the preceding rigours, fever, and several other circumstances, from which a judgment is formed, both with regard to the present and the peculiar nature of the fluid.

FOMENTATION. By a fomentation, surgeons commonly mean the application of flannel or towels, wet with warm water, or some medicinal decoction. In the practice

of surgery, fomentations are chiefly of use in relieving pain, and inflammation, and in promoting suppuration, when this is desirable. Some particular decoctions, however, are used for fomentations, with a view of affecting by means of their medicinal qualities, scrofulous, cancerous, and other sores, of a specific nature. I shall merely subjoin a few of the most useful fomentations in common use.

FOMENTUM AMMONIÆ MURIATÆ.

R. Fomenti Communis ℥ij. Ammon. Mur. ℥j. Spirit. Camph. ℥ij.

Just before using the hot decoction, add to it the ammonia muriata, and spirit. Said to be of service to some indolent ulcers; and, perhaps, it might be of use in promoting the absorption of some tumours, and suppuration in others.

FOMENTUM CHAMÆMELL. R. Lin. contusi ℥j. Chamæmeli ℥ij. Aq. Distillat. ℥vj. Paulisper coque, et cola. A fomentation in very common use.

FOMENTUM CONII. R. Fol. Conii. recent. ℥j. vel. Fol. Conii. exsiccata. ℥ij. Aq. Comm. ℥ij. Coque usque reman. ℥ii. et cola. Sometimes applied to scrofulous, cancerous, and phagedenic ulcers.

FOMENTUM GALLÆ. Gallæ Contusæ ℥ss. Aq. Ferventis ℥ij. Macera per horam. et cola. Used for the prolapsus ani, and sometimes employed, as a cold application, in cases of hemorrhoids.

FOMENTUM PAPAVERIS ALBI. R. Papav. Alb. Exsiccata ℥iv. Aq. Pur. ℥vj. Bruise the poppies, put them in the water, and boil the liquor, till only a quart remains, which is to be strained. This fomentation is an excellent one, for very painful inflammations of the eyes; and for numerous ulcers, and other diseases, attended with intolerable pain.

FORCEPS, an instrument much employed in surgery for a variety of purposes, and having accordingly various constructions. The general design, however, of surgical forceps is to take hold of substances, which cannot be conveniently grasped with the fingers; and, of course, the instrument is always formed on the principle of a pair of pincers, having two blades; either with, or without handles, according to circumstances. The smallest forceps is that which is employed in the operation of extracting the cataract, and which is useful for removing any particles of opaque matter from the pupil, after the chief part of the crystalline lens has been taken away.

Another forceps of larger size, is that used for taking up the mouths of the arteries, when these vessels require a ligature, in cases of hemorrhage. This instrument is also frequently employed for taking dressings off sores, removing pieces of dead bone, foreign bodies from wounds, and, particularly, for raising the fibres, which are about to be cut, in all operations, where careful dissection is required. This forceps resembles that which is contained in every case of dissecting instruments, and is often called

the *artery*, or *dissecting* forceps, from its more important uses.

Neither of the foregoing forceps is made with handles; each opens by its own elasticity; and the ends of the blades only come into contact, when pressed together by the surgeon.

The following kinds of forceps are constructed with handles, by means of which they are both opened and shut:

1. The common forceps, contained in every pocket-case of surgical instruments, and used for removing dressings from sores, extracting dead pieces of bone, foreign bodies, &c.

2. Larger forceps, employed for extracting polypi.

3. Forceps of different sizes and constructions, used in the operation of lithotomy, for taking the stone out of the bladder, or for breaking the calculus, when it is too large to be extracted in an entire state.

***FRACTURE.** (from *frango*, to break.) Is a solution of continuity of one, or more bones, produced in general by external force; but occasionally, by the powerful action of muscles, as is often exemplified in the broken patella.

The subject of fractures is so interesting a branch of surgery, and the accidents themselves so frequent and important, that the little which English surgeons have done for the improvement of this part of their profession cannot but cause equal surprise and regret. Mr. Pott, it is true, made many excellent observations on the treatment of fractures in general; and his remarks on compound fractures in particular are in some respects the best which are extant; but what surgeon will now presume to defend the weak arguments upon which he has founded the doctrine of paying unqualified attention to the relaxation of the muscles, as if this were an object which should constantly supersede every other consideration, and invariably regulate the posture of the limb? I have no hesitation in declaring my own belief, that the doctrine and practice recommended by Mr. Pott, in regard to fractured thighs, have done considerable harm, and the more so, as coming from a man who was deservedly looked upon as one of the best and most experienced judges of surgical practice. Many a surgeon in this country implicitly believed every thing which was asserted by so able a master, and the very observations, which some years ago were here considered to be the glory of their author, and the pride of English surgery, are now exposed by the surgeons of neighbouring countries, as specimens of our wrong precepts and bad practice. M. Roux, in fact, has had but too much room for animadversion upon this subject. We have not only not made a single improvement of consequence in the treatment of any particular fracture, but the generality of our surgical writers have given the most faulty and imperfect account of the diagnosis, and every thing else relating to these accidents. What is worse, a view of our practice con-

veys no better opinion of this part of our surgery. Observe the care and neatness, with which a French surgeon applies the bandages, and splints, and consider how well every indication is accomplished by his apparatus, and you will find great cause both for admiration and imitation. On the other hand, see the slovenly way, in which an English surgeon generally puts on the splints and roller, and the unscientific method, in which he usually treats a fractured thigh, or clavicle, and you cannot fail to be ashamed of the comparison. This was a matchless opportunity for M. Roux to draw a parallel in favour of French surgery, and of course he has not neglected it, many pages of his work being devoted to an explanation of the many improvements Desault made; the little, or rather the nothing, which we have done; and the errors to which we unfortunately still adhere. (See *Voyage fait à Londres en 1814, ou Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise*, p. 173, &c.) It is to be hoped, however, that the period has now arrived, when we shall give to the study of fractures the time, the attention, and the importance, which it claims; and when even the young hospital pupil will not be convinced, that his lecturer by one or two cursory discourses can have done justice to the subject.

In this article, my plan is to follow the arrangement pursued by Boyer, in his *Traité des Maladies Chirurgicales*, T. 3. I shall first speak of fractures in general, and allot separate sections to the consideration of, 1. Their differences; 2. Their causes; 3. Their symptoms; 4. Their prognosis; 5. Their treatment; 6. The formation of callus.

The subject will then conclude with a full account of the symptoms, causes, and treatment of the fractures of particular bones.

1. Differences of Fractures.

The differences of fractures depend upon what bone is broken; what portion of it is fractured; the direction of the fracture; the respective position of the fragments; and, lastly, upon circumstances accompanying the injury, and making it simple, compound, or variously complicated.

1. *In respect to the bone affected.* Sometimes it is one of the broad bones, as the scapula, the sternum, or the os ilium.— Sometimes it is a short bone, like the os calcis; but, far more commonly it is one of the long bones. The situation and functions of the broad bones render their fractures unfrequent. The bones of the skull are the only exception to this remark, for they are often broken; but, here the assistance of the surgeon is required less for the solution of continuity itself, than for the affection of the brain, and the extravasation of blood, with which the case is apt to be combined. Fractures of the short bones are still more unusual, because these bones, being nearly equal in their three dimensions, are capable of greater resistance,

and are not much within the reach of external violence. Besides, most of them are but little exposed to the operation of outward force, by their situation, or functions. Hence, unless limbs are crushed, fractures of short bones are generally caused by the action of the muscles, which also frequently breaks the patella, olecranon, and os calcis. The long bones, which serve as pillars, or arches of support, or levers, are by the very nature of their functions, particularly liable to fractures.

2. *In respect to the part of the bone broken.* Bones may be fractured at different points of their length. Most commonly, their middle portion is broken, and, in this circumstance, they usually break like a stick, which has been bent beyond its extensibility by a force applied at each end of it. Sometimes the fracture occurs more or less near the extremities of the bone, which is always an unfavourable event, as will be explained in considering the prognosis. Lastly, the bone is sometimes broken in several places, and the injury may be produced by two different causes, which have operated successively, or simultaneously, upon the broken parts of the bone; or it may be occasioned by one single cause, which has acted at the same moment upon several points of it. These distinctions of fractures, deduced from their particular situation, (says Boyer) are not merely scholastic refinements; they have truly an important influence over the prognosis and treatment, as will be hereafter seen.

3. *In respect to the direction, in which the bone is broken.* A bone may be fractured in various ways, and the fracture receives different names, according to its direction in regard to the axis of the bone. Thus, fractures are distinguished into *transverse* and *oblique*. The obliquity renders the surface of the injury larger, and materially increases the difficulty of maintaining the ends of the bone in contact, after they have been set. Oblique fractures are subject to considerable variety, which depends upon the degree of their obliquity, and whether they are partly oblique and partly transverse. When a bone is broken in different places at once, and divided into several fragments, or splinters, the fracture is termed *comminuted*.

Duverney admitted another class of fractures, viz. *longitudinal*. (See *Traité des Maladies des Os*, T. 1, p. 167.) But J. L. Petit regarded this species as only imaginary, because he conceived that any blow which was capable of breaking a bone longitudinally, would much more readily cause a transverse fracture. For the same reason, Louis absolutely rejected the possibility of longitudinal fractures, and this sentiment has been the prevailing one up to the present day.

The following case, however, is related by Leveillé, in order to prove the possibility of longitudinal fractures. This surgeon amputated the thigh of an Austrian soldier who was put under his care in the year 1800, in

consequence of being struck by a ball in the lower third of the leg, at the battle of Marignano. The soldier had walked several miles after receiving the injury, before he arrived at Pavia. The wound appeared simple, and likely to heal as soon as the injured portion of the tibia had exfoliated. The event turned out otherwise, and the thigh was amputated.

Levillé has preserved the tibia, upon which the impression of the ball may be distinguished, and from this point, run several longitudinal and oblique lines, which extend from the lower third towards the upper head of the tibia, and pass through the whole thickness of the parietes of the medullary canal. They are acknowledged to be really longitudinal fractures, by Dubois, Chauffrier, Duméril, Deschamps, and Roux, who were appointed by the Ecole de Médecine to inquire into the fact. (*Levillé, Nouvelle Doctrine Chir. T. 2, p. 158.*)

In a foregoing article of this dictionary, I mentioned that, in several of the cases of fractured thigh bones from gun-shot violence, which were under the care of Dr. Cole and myself in Holland, the bone was split longitudinally to the extent of seven or eight inches. (See *Amputation.*) The fact, however, that bullets and other balls do produce longitudinal fractures, is now universally admitted; and were there any doubt upon the subject, a specimen sent to England by my friend Dr. Cole would soon remove it. Boyer, who a few years ago denied the possibility of longitudinal fractures, in his late work remarks:—"On trouve néanmoins, à la suite des plaies d'armes à feu, les os fendus suivant leur longueur, jusques dans leurs articulations,"—but he is correct when he adds, that such instances afford no proof of the possibility of a simple longitudinal fracture. (See *Traité des Maladies Chir. T. 3, p. 10.*)

4. In regard to the respective position of the fragments. These differences are highly important to be understood, because, as Boyer remarks, the treatment of fractures consists almost entirely in remedying, or preventing the displacement of the fragments. It is not to be supposed, however, that such displacement is an absolutely essential symptom of all fractures, for it seldom exists in members composed of two bones, when only one of them is broken. Neither does it constantly happen in every fracture of the neck of a bone, as is exemplified in certain fractures of the neck of the thigh-bone, the fragments of which sometimes change their relative situation only when the patient tries to walk, or the limb is imprudently moved about. Fractures of the leg are also observed, in which there is neither a displacement of the fragments, nor an alteration in the shape of the limb, especially when the tibia alone is fractured near its upper part, where it is very thick. When the ulna alone is broken at its upper part, there is hardly ever any displacement. The corresponding surfaces of the fragments having a large extent cannot

be separated, or can only be so with difficulty. The fibula also resists the causes, which tend to produce displacement. But it is a symptom which almost invariably occurs when both bones of the leg, or fore-arm, are fractured together; as also in fractures of limbs which contain only one bone, on account of the little extent of the surfaces of the fracture, and the great number of muscles, which tend to displace them.

The displacement may happen in respect to the diameter, length, direction, or circumference, of the bone.

In respect to the diameter. Transverse fractures are the only cases, in which this kind of displacement is observed. The two fragments may either be in contact at a part of their surfaces, or they may not be in contact at all. In the latter circumstance, the limb is shortened by the ends of the fracture slipping over each other.

In respect to length. This mode of displacement, in which the ends of the broken bone ride more or less over each other, constantly occurs in oblique fractures, and sometimes in transverse ones, when the displacement in the direction of the diameter of the bone has been such that the surfaces of the fracture are no longer in contact. It will be hereafter explained, that whenever the limb is shortened in fractures of the extremities, it is the lower fragment which is displaced.

We may refer to the species of displacement here spoken of, that which takes place in fractures of the patella, olecranon, and os calcis; but with this difference, that the fragments, instead of riding over each other, separate from each other in the direction of the length of the bone, and continue separated by an interspace more or less considerable.

In respect to the direction of the bone. In this kind of displacement, the two fragments form an angle more or less prominent, and the bone appears arched. It is principally observed in comminuted fractures. It may also happen in simple fractures; for instance, in the leg, when the limb in a strait posture does not lie upon a surface exactly horizontal, and the heel is lower than the rest of the leg. The angular projection is then anterior. On the contrary, it would be posterior if the heel were too much raised.

In respect to the circumference of the bone. This displacement occurs when the lower fragment performs a rotatory movement, while the upper one continues motionless. Thus, in fractures of the neck of the femur, if the foot is badly supported by the apparatus, its weight, together with that of the limb, and the action of the muscles, inclines it outward, and turns the lower fragment in the same direction.

Besides the simple displacements above described, there are others of a more complicated nature, which happen in several directions at once. For example, such is the displacement which is observed in a fracture of the thigh-bone, when the lower

fragment is drawn upward and inward, while the foot is turned outward.

Let us next consider the causes producing the displacement of fractures.

The bones being only passive instruments of loco-motion, possess not, in their own organization, any cause of the change of situation which takes place; but yield to the impulse of external bodies, the weight of the member, and the action of the muscles.

The displacement may be produced by an external force, either at the moment when the fracture happens, and by the very action of the fracturing cause itself; or it may be caused by the weight of the body when the fracture precedes the fall; or lastly, it may be brought on by some other external force, acting on the fragments, sooner or later, after the occurrence of the injury.

The outward violence, which is productive of a fracture, operates sometimes directly on the situation of the breach of continuity; sometimes on parts more or less distant from this place. In both cases, the action of the force is not confined to the production of the fracture, but is partly spent in causing a displacement of the fragments.

Falls are the most usual causes of fractures. But sometimes, the fall does not happen till after the leg, or thigh, is actually broken. The weight of the body then produces the displacement, by pushing the upper fragment against the soft parts, which are more or less lacerated. This is what happened to Ambrose Paré. This celebrated surgeon, being kicked by a horse, endeavoured to get out of the way; but he instantly fell down, and the two bones of his left leg, which had been fractured, being impelled by the weight of the body, not only passed through the skin, but even through his stockings and boot. Boyer has seen a case nearly similar in a young man about twenty years of age, who, in a standing posture, was struck on the middle of the thigh with the pole of a carriage, which fractured the femur. The patient fell down, and in the fall the upper fragment was not only driven through the muscles and integuments, but also through his breeches.

The weight of the limb itself may produce displacement according to the direction, or circumference of the bone, as already detailed. The disturbance of the limb, also, in lifting the patient, and carrying him to his bed, may sometimes alter the relative situation of the fragments, and cause them to be displaced.

But of all the causes of the displacement of fractures, the action of the muscles is the common and most powerful one. Among those muscles which surround a fractured bone, some are attached to it throughout its whole length, and are equally connected with both the fragments. Some arise from the bone above, and are inserted either into that, which is articulated with the lower fragment, or into the lower fragment itself. Lastly, there are others, which come from a point more or less distant, and terminate in the upper fragment. The muscles round the

thigh bone furnish examples of these three arrangements. The triceps is attached to the bone its whole length. The biceps, semi-membranosus, and semi-tendinosus, come from the pelvis, and are inserted into the leg, a part, with which the lower fragment is articulated, and all the motions of which it follows. The great head of the biceps is inserted into this fragment itself. Lastly, the iliacus, psoas, pectineus, &c. come from the loins and pelvis, and are attached to the femur, not far from its upper end.

The muscles which are attached to both fragments, contribute very little to their displacement. They may, however, draw them to the side on which they are situated, and thus change the direction of the limb. The triceps, especially its middle portion, acts in this manner in fractures of the femur, and renders the thigh convex anteriorly. The coraco-brachialis tends to produce the same effect, when the humerus is broken below its middle.

The displacement is principally owing to such muscles as are affixed to the lower fragment, or part with which this fragment is articulated. Suppose the humerus to be broken between its upper end and the insertion of the great pectoral. This muscle, aided by the latissimus dorsi and teres major, will draw the lower fragment inward, and displace it by drawing it to the inner side of the upper fragment, which remains motionless. In fractures of the neck of the thigh bone, the upper fragment, included within the capsular ligament, affords attachment to no muscle. All those, which are affixed to the lower fragment, pull it upward and backward, in which direction the displacement is inevitable. In all fractures, the lower fragment follows every movement made by the part of the limb with which it is articulated, and, consequently, the muscles which are attached to the bones of this last part of the limb, become a powerful cause of displacement. Thus, in a fracture of the thigh bone, the biceps, semi-tendinosus, and semi-membranosus, draw the leg, and with it the lower fragment, upward, inward, and backward, so as to make the lower end of the fracture ascend at the inside of, and rather behind the upper one, the extremity of which then projects forward and outward. In a fracture of the leg, the gastrocnemius, soleus, and peronei muscles, acting upon the foot, pull the lower fragments of the tibia and fibula, and draw them to the outer and posterior side of the upper fragments. For, here, as well as every where else, the strongest muscles, in producing the displacement, draw towards their own side the end of the fracture, on which they operate. And as the posterior muscles of the leg are far more numerous and powerful than those on the front of the limb; while those on its outside are not antagonized by any others; the displacement must happen in the direction backward and outward. Whenever therefore a bone is fractured at a given point, an anatomical know-

ledge of the muscles will enable one to determine *a priori* in what direction the displacement will occur, if no means be taken to impede it, and it proceed altogether from this particular cause.

Lastly, the muscles, which are attached only to the upper fragment, may sometimes displace it. In a fracture of the thigh, situated immediately below the little trochanter, the psoas and iliacus muscles together carry forward the extremity of the upper fragment, which elevates the integuments, and forms a more or less considerable projection near the fold of the groin. But, it is to be observed, that, in general, the displacement of the upper fragment is not common, and that it is the lower one which is drawn out of its proper position.

The manner in which the displacement of fractures is effected by the action of muscles, explains one circumstance, which frequently attends these cases, especially fractures of the thigh, clavicle, and leg. This is a rising, a projection of the upper fragment, or that which is nearest the trunk. One might believe, at first sight, that such projection is formed by the upper fragment, which, abandoning its natural situation rises over the lower one. But on the least reflection, it becomes manifest, that the upper end of the fracture projects only because the lower one is displaced, and drawn towards that side on which the strongest muscles are situated. Thus, in practice, in order to make the *rising end of the bone*, (as it was termed) disappear, it is only necessary to reduce the lower fragment into its natural place. If instead of doing this, pressure is made on the projecting part, the design fails; and if the plan be still more forcibly pursued and continued, inflammation and sloughing of the integuments and other soft parts, are likely to be the unfortunate consequences.

5. *In respect to circumstances, with which fractures are accompanied.* The most important division of fractures is into *simple* and *compound*.

By a *simple fracture*, surgeons mean a breach in the continuity of one or more bones, without any external wound, communicating internally with the fracture, and caused by the protrusion of the ends of the broken bone, or bones. By a *compound fracture*, they signify the same sort of injury of a bone, or bones, attended with a laceration of the integuments, which laceration is produced by the protrusion of one, or both ends of the fracture.

The dangerous nature of compound fractures will be fully explained in the sequel of this article, and we have already adverted to the subject in speaking of *Amputation*.

Fractures are said to be *complicated*, when they are attended with diseases, or accidents, which render the indications in the treatment more numerous, and require the employment of different remedies, or the practice of sundry operations for the accomplishment of the cure.

Thus, fractures may be complicated with

severe degrees of contusion, wounds of the soft parts, the injury of large blood-vessels, a dislocation, or disease, such as the scurvy, rickets, lues venerea, &c. which are said to retard the formation of callus, and render the cure more backward.

The complication of fracture with dislocation happens but seldom, and it cannot occur, unless the luxation has taken place first, or has been produced at the same time with the fracture, and by the same cause. When once the fracture has happened, the fragments are not sufficiently within the grasp of external force; and are too moveable to admit of the bone being dislocated.

A patient with fracture may be attacked by an acute disease, which may render the treatment more troublesome, and the cure slower.

2. Causes of Fractures.

The causes of fractures are divided into *predisposing* and *remote*.

In the first class are comprehended, the situation and functions of the bones, the age of the patients, and their diseases. Superficial bones are more easily fractured than those which are covered by a considerable quantity of soft parts. The functions of some bones render them more liable to be fractured than others; thus the radius, which supports the hand, is more liable to be fractured than the ulna. The clavicle, which serves to keep the shoulder in its proper position, and support on its arched extremity all the motions of the upper extremity, is particularly subject to be broken. The gradual increase of the quantity of the phosphate of lime, in the structure of the bones, makes them brittle, in proportion as we advance in years, and in old age, the proportion of the inorganized to the organized part is so great, that the bones are fractured by the slightest causes. In childhood, the fibrous and organized part bears a greater proportion to the earth, and the bones being, consequently, more elastic and flexible, are not so easily broken, as in old age.

Lues venerea, arthritis, cancer, rachitis, scurvy, and scrofula, says Levéillé, predispose to fractures. B. Bell mentions two venereal patients, of whom the hardest and largest bones were completely broken by the ordinary action of the muscles of the limb. Fabricius Hildanus quotes from Sarazin, a physician of Lyons, the case of a gouty patient, sixty years of age, who, in putting on his glove, broke his arm; the fracture having been ascertained three days afterward to be situated above the elbow. Desault used often to speak of a nun of Salpêtrière, whose arm was broken as a person was handing her out of a carriage. Louis, who was vexed that no union took place, was not a little surprised to find her thigh bone experience the same fate one day as she was changing her posture in bed. It was then that Louis learned that this lady had a cancer in her right breast. Levéillé as-

tures us, that he has observed similar cases in the Hôtel Dieu.

According to this last writer, the history of two girls is related by Buchner, one of whom died rickety at the age of sixteen, having broken the femur a short time before her death; and the other, after taking the breast very well for two years, and thriving for a time, became affected with rachitis, and met with the same accident as she was merely running along the street. (*Nouvelle Doctrine Chir. Tom. 2, p. 163.*)

Many extraordinary instances of fractures from the morbid softness and fragility of the bones are upon record. Suffice it here, to refer to the Philosophical Transactions; *Mém. de l'Acad. Royale des Sciences*; *Act. Hafniens.*; *Ephem. Nat. Cur. Dec. 1, Ann. 3, Obs. 112*; Gooch's *Chirurgical Works*, Vol. 2; Saviard's *Observations Chirurgicales*, p. 274, &c. (See also *Fragilitas and Mollities Ossium.*)

On the subject of fractures, produced by the scurvy, Leveillé recommends us to peruse Marcellus Donatus; Saviard's *Observations*; Heyne de *Morbis Ossium*; Poupard's *Works* inserted in the *Mém. de l'Acad. de Sciences*, 1699; and the Treatise published at Verona, in 1761, by Jean de Bona.

Paré, Platner, Callisen, and several other writers, set down cold, as a predisposing cause of fractures. This doctrine has originated from these injuries being more frequent in the winter time, and is quite erroneous, since, in cold countries, the greater number of falls, which happen in winter, is a circumstance that fully explains why fractures are then more common than in summer.

The remote cause of fractures is external force, variously applied, in falls, blows, &c. In particular instances, the bones are broken by the violent action of the muscles attached to them; this is almost always the case with the fractured patella. The olecranon and os calcis have likewise been broken by a violent contraction of the muscles inserted into them. With respect to the heel, Petit records two instances, one of which was communicated to him by Poncelet, and the other seen by himself in Madame La Presidente de Boissire, who met with the accident in walking a gentle pace in the court of the Hôtel de Soubise. When the injury happens in leaping, or falls from a high situation, Leveillé thinks it more probable, that a portion of the os calcis is torn off by the powerful action of the muscles of the calf, than that it is broken by any blow immediately on the part. He states, that Desault used frequently to cite two examples of this kind, one of which is recorded in his *Œuvres Chirurgicales*.

Whether the long bones can be fractured by the mere action of the muscles, is yet an unsettled point. In the Philosophical Transactions, a fracture of the humerus is ascribed to this cause, and Botentuit saw the same accident produced by striking a shuttlecock with a battledore. According to De-beaumarchef, as a man was descending a

ladder at a quick rate, his heel got entangled in an opening, and he made a violent exertion to avoid falling. The consequence was a fracture of the lower third of the leg. Curet informs us, that a cabin-boy, aged seventeen, made a considerable effort to keep himself from being thrown down by the rolling of the ship, as he was making water. The femur was fractured by the powerful action of the muscles of the thigh. The lad had no fall, and, with some difficulty, supported himself on the other limb, till he received assistance.

We are told, says Lavéillé, by Poupée Desportes, that a negro, about twelve or thirteen years old, was seized with such violent spasmodic contractions of the muscles of the lower extremities, that the feet were turned backward, and the neck of each thigh bone was fractured, the ends of the broken bones also protruding through the skin upon the outside of the thigh. A cure was effected, after an exfoliation. We read also, in the *Mélanges des Curieux de la Nature*, that, during a fit of epilepsy, a child, ten years old, had its left humerus and tibia broken, and that upon opening the body, other solutions of continuity were observed. Doctor Chamseru recollects having assisted, at his father's house, in dressing a child, eleven or twelve years old, that had broken the humerus in throwing a stone a considerable distance. (*Leveillé, Nouvelle Doctrine Chir. T. 2, p. 164, 166.*)

Richerand, however, positively denies, that a long bone, when healthy, can ever be broken by the mere contraction of the muscles. (*Nosogr. Chir. T. 3, p. 12, Edit. 4.*)

For my own part, making all due allowance for the inaccuracy of some of the reports made by writers, I think the possibility of the long bones being broken by the violent action of the muscles is sufficiently proved. I have never seen but one example of the occurrence; but, it was a very unequivocal one. I once attended for the late Mr. Ramsdens, an exceedingly strong man, at Pentonville, who broke his os brachii in making a powerful blow, although he missed his aim and struck nothing at all. The whole limb was afterward affected with vast swelling and inflammation. This man, I remember, was also visited by Mr. Welbank, of Chancery-lane. According to Nicod, the greater number of fractures of long bones, by mere muscular action, are preceded by pains in the broken limbs, and, in one of the cases, published by this author, not only was this circumstance remarked, but an abscess and exfoliation of a portion of the fractured humerus ensued. In another instance, reported by this gentleman, the clavicle, in a state of preternatural fragility from disease, was fractured in an effort to carry the arm far behind the back. After the reunion of the fracture, an abscess took place, and a piece of the bone exfoliated. (*Annuaire Med. Chir. des Hôpitaux de Paris, p. 494-98, &c. 4^{to}. Paris, 1819.*)

3. Symptoms of Fractures.

Some of the symptoms of fractures are equivocal. The pain, and inability to move the limb, commonly enumerated, may arise from a mere bruise, a dislocation, or other cause. The crepitus: the separation and inequalities of the ends of the fracture, when the bones are superficial; the change in the form of the limb; and the shortening of it; are circumstances, communicating the most certain information; and the crepitus, in particular, is the principal symptom to be depended upon. The signs of fractures, however, are so exceedingly various, according to the bones, which are the subject of injury, that it cannot be said, that there is any one, which is invariably attendant on such cases, and characteristically confined to them. The writers of systems of surgery usually notice loss of motion in the injured limb, deformity, swelling, tension, pain, &c. as forming the general diagnosis of fractures. However, it is easily comprehensible by any one, acquainted with anatomy, that numerous fractures cannot prevent the motion of the part, nor occasion outward deformity; and every surgeon must know, that though, at first, there may be pain in the situation of a fracture, no swelling and tension take place till after a certain period.

When, therefore, a limb is broken, and the event is not manifest from the distortion of the part, it is proper to trace, with the fingers, the outlines of the suspected bone: if it be the tibia, let the surgeon examine with his fingers, whether any inequality can be discovered along the anterior surface, and along the sharp front edge of that bone. If it be the clavicle, let him trace the superficial course of the bone, in the same attentive manner. Whether any unusual pain occurs, or any unnatural irregularity appears, let him try, if a grating, or crepitus, cannot be felt, on endeavouring to make one end of the suspected fracture rub against the other. When the humerus, or the os femoris, is the subject of inquiry, a crepitus is felt almost as soon as the limb is touched, and, in the case of the broken thigh, there is a considerable shortening of the extremity, except in a few cases of fractures, completely transverse. But, when there are two bones, as in the leg and the fore-arm, and only one is broken, the other continues to prevent the limb from being shortened, and thrown out of its natural shape, so that a crepitus can only be felt by a very careful examination with the fingers. The difficulty of the diagnosis is increased, when the surgeon is consulted late, and great swelling has come on. Where is the surgeon, says Boyer, that has not sometimes hesitated to deliver an opinion in certain cases of this description? (*Traité des Malad. Chir.* 3, p. 27.)

When the injured limb is shortened, the surgeon, before pronouncing that such change proceeds from the riding of the fragments over each other, must be sure, that the bones are not dislocated, and that the limb is not naturally shorter, than the

other, or in consequence of a previous fracture, that has been badly set.

In comparing the length of the lower extremities, one should place the pelvis in an horizontal position, and put the two anterior superior spines of the ossa ilium in the same line; for, if these processes are not on a level, the limb, towards which the pelvis inclines, will seem longer than the opposite member.

The practitioner, who is well acquainted with the conformation of the limbs, and particularly with the mutual relations of the eminences of the bones to each other, will readily perceive the alterations produced by a fracture. Whenever, in consequence of a fall, or a blow, a limb becomes concave at a part, where it ought to be convex; or straight, et vice versa; the change of shape and direction must proceed from a fracture with displacement. The inner edge of the great toe, when the leg rests on an horizontal surface, should correspond with the inner edge of the knee-pan. If this natural relation be altered; if the inner edge of the great toe correspond with the outer edge of the knee-pan, there can be no doubt of the existence of a fracture of both bones of the leg. (Boyer, *Vol. cit.* p. T. 3, p. 25.)

I am aware, that considerable harm, and great unnecessary pain, have been occasioned in the practice of surgery, by too much solicitude to feel the grating of fractured bones, and, whenever the case is sufficiently evident to the eyes, the practitioner who gives way to this habit, at the expense of torture to the unfortunate patient, ought, in my opinion, to be severely censured. A fracture is an injury, necessarily attended with a great deal of pain, and followed by more or less swelling and inflammation; and to increase these evils by roughly, or unnecessarily handling the part, is ignorantly cured, (if I may use the expression) unsurgical.

In some kinds of fractures, the broken bone is so surrounded with thick fleshy parts, that it is difficult to feel a crepitus, or ascertain the existence of the injury. Some fractures of the neck of the thigh bone, unattended with much retraction of the limb, are instances illustrative of this observation.

4. Prognosis of Fractures.

The Prognosis of fractures varies, according to the kind of bone injured, what part of it is broken, the direction of the breach of continuity, and what other mischief complicates the case. Fractures of bones, which have many strong muscles inserted into them, are more difficult of cure, than those of other bones, which have not so many powers attached to them, capable of disturbing the fragments.

A fracture of the middle part of the long bone, is less dangerous, than a similar injury near a joint. Fractures near joints may occasion a false ankylosis. Thus, in a fracture of the thigh-bone, near the condyles, the inflammation and swelling extend to the knee-joint, which is affected with a

degree of stiffness that continues for a long while, and sometimes cannot be entirely cured during life. Besides, the inflammation of the joint is attended with more severe symptoms, in consequence of the contusion having been more violent. In a fracture near an articulation, it is to be observed, also, that the splints have no command over the short fragment, so that it is often difficult to prevent displacement. Hence, a fracture of the neck of the thigh-bone is considered a worse case, than a similar injury of the body of the bone.

When a bone is fractured in several places, the case is more serious, and the difficulty of cure much augmented. But, the accident is still worse, when a limb is fractured in two different places at once; as, for instance, in the thigh and leg. Here it is almost impossible to reduce the fracture of the thigh, and maintain the reduction well, so as to preserve the natural length of the limb. (*Boyer, Traité des Mal. Chir. T. 3. p. 29.*)

Oblique fractures are more troublesome, and difficult of cure, than transverse ones, because an oblique surface does not resist the retraction of the lower portion of the broken bone, and consequently it is very difficult to keep the ends of the fracture duly applied to each other.

Fractures complicated with violent contusion of the soft parts, or with a wound rendering them compound, are much more dangerous, than others free from such accidents. The bad symptoms, which render compound fractures so dangerous, are of many kinds: hemorrhage; violent and extensive inflammation of the limb, with extreme pain, delirium, and fever; large abscesses; gangrene; &c. Fractures of the leg are generally more serious, than similar injuries of the upper extremity. The wound of a large artery may add considerably to the danger of a fracture.

In a debilitated old man, a fracture is less likely to end well, than in a healthy child, or strong young subject. In extreme old age, the cure of a fracture is always more difficult, and sometimes impossible. (*Boyer, T. 3, p. 32.*) The scurvy certainly retards the formation of callus; but, it is not true that pregnancy always prevents the union of fractures. Some years ago, I attended for Mr. Ramsdens, a woman in a court, leading out of St. Paul's Church-yard, who broke both bones of her leg, when she was seven months gone with child. Her pregnancy, however, did not appear to be at all unfavourable to the cure, as she got quite well in the usual time. "It is not generally settled," says a modern writer, "whether pregnancy should be accounted a complication. I have, as well as some other practitioners, seen a pregnant woman get well of a simple fracture in the ordinary time." (*Leveillé, Nouvelle Doctrine Chir. T. 2, p. 159.*) And in another place he says, "*Contre l'opinion de Fabrice de Hilden, l'expérience m'a prouvé que, chez les femmes grosses, le cal était aussi prompt à se former, que chez toute autre personne.*" (*Op. cit. Tom. 2. p.*

172.) The experience of Boyer also tends to prove, that pregnancy is not unfavourable to the union of fractures. (*See Traité des Mal. Chir. T. 3, p. 32.*)

The cases in which fractures remain disunited, will be considered in a future section of the present article.

5. Treatment of Fractures in general.

The general treatment of fractures embraces three principal indications. The first is to reduce the pieces of bone into their natural situation. The second is to secure and keep them in this state. And the third is to prevent any unpleasant symptoms likely to arise, and relieve them when they have come on.

The first indication is only applicable to cases attended with displacement; for when the fragments are not out of their relative position, the surgeon must strictly refrain from all avoidable disturbance of the limb. His interference should then be limited to putting up the fracture, resisting the accession of all unfavourable symptoms, and removing them, if possible, after they have taken place.

6. Of the Reduction of Fractures.

The means employed for the reduction of fractures in general, are chiefly three, viz. *extension*; *counter-extension*; and *coaptation*, or *setting*. But as Boyer remarks, these means should vary according to the species of displacement; and surgical writers have generalized too much in representing them all three as necessary for the reduction of every kind of fracture. In fact, there are several cases, in which extension and counter-extension are positively useless: of this nature are fractures of the patella and olecranon, where the displacement consists of a separation of the fragments. Here the reduction may be accomplished, by putting the limb in a position, in which the muscles attached to the upper part of the bone are relaxed, and then pushing the upper fragment into contact with the lower.

Extension signifies the act of pulling the broken part in a direction from the trunk, with a view of bringing the ends of the fracture into their natural situation. By counter-extension, surgeons imply the act of making extension in the opposite direction, in order to hinder the limb, or even the whole body, from being drawn along by the extending power, which would then be unavailing.

It was formerly recommended to apply the extending force to the lower fragment, and the counter-extension to the upper one. Such practice, indeed, was advised by Mr. Pott, and is still generally preferred in this country; but upon the continent, it has been abandoned. The objections alleged against it by Boyer are; first, that it is frequently difficult and sometimes impossible, to take hold of the two fragments; as, for example, when the neck of the thigh-bone is broken. Secondly, that by applying the extension and counter-extension to the broken bone

itself, most of the muscles, which surround it, are compressed, and such compression produces in these organs a spasmodic contraction, which often renders the extension and counter-extension useless, and sometimes even hurtful. (*Traité des Mal. Chir. T. 3, p. 34.*) The French surgeons, therefore, apply the extending force to that part of the limb, which is articulated with the lower fragment, and the counter-extension to that which is articulated with the upper. For instance, in a fracture of the leg, the extending means act upon the foot; and the counter-extending upon the thigh; and in a fracture of the thigh, the extension is applied to the leg, while the counter-extending power fixes the pelvis.

One circumstance must here occur to the mind of the surgical reader. In this country, it is properly inculcated, that one of the first principles to be attended to in the reduction of fractures, is to put the limb in such a position as will relax the most powerful muscles connected with the broken bone; because these muscles principally impede the reduction, and disturb the ends of the fracture. But in the French mode of making the extension and counter-extension, how can this grand principle be observed? If the extending and counter-extending means are not to be applied to the broken bone itself; but to others, which are articulated with it, the limb must of necessity be kept in a straight posture at the time of reducing the fracture; for, were the member placed in a half-bent state, the extension and counter-extension, as practised by the continental surgeons, would not be in the same line. If, therefore, it be advantageous to bend the limb at the time of reducing a fracture, the French mode of practising extension and counter-extension must be relinquished. I am not, however, one of those surgeons, who are entirely blinded with the idea of the possibility of relaxing the whole of the muscles, connected with the broken bone, by merely bending the limb. On the contrary, I am perfectly convinced with Desault, that in general, what is gained by the relaxation of some muscles, is lost by the tension of others. But where it is possible to relax by a certain posture the set of muscles most capable of preventing the reduction and disturbing the coaptation of a fracture, that posture I would select. Thus, in a fracture of the leg, the strong muscles of the calf undeniably possess this power, and the bent position, which relaxes them, appears to me therefore the most judicious and advantageous, not only during the reduction, but during the whole treatment of the case. A few years ago, I had under my care, in the military hospital at Cambray, a fracture of the tibia and fibula, which was at first treated in the straight posture. The gentlemen who assisted me, reduced the fragments, and made them lie tolerably well. But every time the bandage was opened, the bones were always found displaced again. Finding that this inconvenience went on for two or three weeks, we resolved to lay the limb on its outside, in the

bent position. Not the least trouble was afterward experienced in keeping the fragments reduced. Unless, therefore, the situation of a wound, abscess, or some particular reason indicate an advantage or convenience from the straight posture, I always reduce a fractured leg in the best position, which will be hereafter described. Here, therefore, I consider the French mode of making the extension and counter-extension as generally inadmissible.

I was also formerly of opinion, that the bent position of the limb on its side, as advised by Mr. Pott, was the best for fractured thighs; but this sentiment has subsequently appeared to me erroneous, and it gives me pleasure to have this opportunity of declaring my entire conversion to the principles and practice adopted in these cases by Desault, and other eminent continental surgeons. The considerations which have led me to this change, will be related in speaking of fractured thighs. If then the straight posture be advantageous in cases of broken thighs, I think it will be universally allowed, that the parts of the limb, recommended by the French surgeons for the application of the extension and counter-extension, are the most proper.

The evils and difficulties formerly encountered in setting fractured limbs, undoubtedly proceeded in a great measure from the violent extension and counter-extension practised by our ancestors. As they were ignorant of the utility of relaxing the muscles, which displaced the ends of the broken bone, they had no means, but the employment of actual force, to effect the reduction. Since, however, the excellent instructions, contained in Mr. Pott's remarks on fractures, have received all the attention due to them, practitioners have generally been careful, in the reduction of fractures, to incapacitate the muscles as much as possible by relaxing them, and thus the necessity for the employment of violent extension and counter-extension is effectually removed.

It is difficult to lay down rules, respecting the precise degree of force which should be used in making extension; for it must vary in different cases, according to the species of displacement, and the number and power of the muscles concerned in producing it. In transverse fractures, displaced only according to the diameter of the bone, a very moderate extension suffices, as it is merely practised with a view of lessening the friction of the surfaces of the fracture, which are always more or less rough. But whatever be the direction of the fracture, when the fragments ride over each other, the extension and counter-extension must constantly be such as to remove the shortening of the limb, and overcome the force of those muscles, which, after all attention has been paid to their relaxation, still oppose the reduction. Extension, however, ought never to be practised in a violent and sudden way; but in as gradual a manner as possible, the utmost care being taken not to shake, nor even move the limb any more than can be avoided. When the practitioner extends a

broken member all at once violently, he excites the muscles to strong spasmodic action, and there is some danger of lacerating them, because their fibres are not allowed the requisite time to yield to the force, which elongates them. The extension is to begin in the direction of the lower fragment, and be continued in that, which is natural to the body of the bone.

In every case of fracture with displacement, as soon as the necessary extension has been made, the surgeon is to endeavour to place the ends of the broken bone in their natural situation: this is termed *coaptation*, or *setting*. This operation is to be undertaken in different ways, according to the species of displacement, and the practitioner can almost always execute it by acting upon the lower fragment, without applying his fingers directly to the fracture itself, in order to regulate the contact of the extremities of the bone. When, however, it is judged necessary for this purpose to touch the broken part itself, it should be done with the utmost gentleness, so as to avoid pressing the soft parts against the points and splinters of bone.

Although the reduction of fractures may in general be accomplished with tolerable facility, it sometimes happens, that the first attempts fail. This is occasionally ascribable to the employment of too much force, and too little management, in making the extension; so that the muscles are irritated, and act so powerfully, that the design of the surgeon is completely frustrated. Here, the grand means of success is putting the limb into such a position, as will relax the most powerful muscles, which oppose the reduction. Sometimes, however, the irritable and convulsive state of the muscles is not the effect of any wrong mode of proceeding on the part of the surgeon; but arises from the alarm, pain, and injury, caused by the accident itself. Here relaxing the muscles as much as possible is also the most likely method of removing the difficulty. In short, now that the utility of paying attention to this principle is universally known in the profession, a fracture is hardly ever met with, which cannot be immediately reduced; particularly if a copious bleeding be premised when the patient is a strong muscular subject. This evacuation, indeed, will also prove for other reasons highly beneficial, where the limb is much contused and swollen, and the tendency to inflammation is great.

7. Of the means for keeping Fractures reduced.

After the bones have been put into their natural situation, time alone would complete their cure, were there not in the muscles a continual propensity to displace the ends of the fracture again. In cases of fracture, these organs are often affected with involuntary spasmodic action, by which the broken part would certainly be displaced, were no measures taken to maintain the extremities of the broken bone in contact. Besides, the patient in easing himself, coughing, sneez-

ing, &c. must unavoidably subject the limb to a degree of motion by which the coaptation would be altogether destroyed. Hence, the necessity of employing means for fixing the broken limb so effectually, that it may continue perfectly motionless during the whole time requisite for the union of the fracture. This second indication is sometimes troublesome and difficult, and, as Boyer observes, it is in this part of the treatment, that the surgeon has an opportunity of evincing his skill and experience. The means employed for the fulfilment of this indication are, an advantageous position; quietude; bandages; splints; and various kinds of apparatus.

In the treatment of all fractures, the position of the part, and indeed of the whole body, is a thing of material importance. Whenever the case is a fracture of the lower extremities, the patient should lie strictly in bed, until the callus is completely formed. It is likewise an advantage not to have the bed much more than a yard wide, because the surgeon and assistants can then more conveniently get at any part of the limb. Feather beds are a great deal too soft and yielding: a horsehair mattress is far preferable. Boyer, indeed, is so impressed with the utility of letting the patient lie upon a surface, which will not sink, that he recommends two mattresses to be used, and a board to be laid under the upper one, from the hip to beyond the patient's foot. (*Traité des Mal. Chir. p. 39, Vol. 3.*)

The most favourable position for a fractured limb, is that, in which all the muscles, passing over the fracture, and extending either to the lower fragment, or to that part of the limb which is articulated with it, are equally relaxed. The injured limb should also have firm support at every point, and its position ought to be regulated so that not only this object be carefully fulfilled, but at the same time the chance of displacement from the action of the muscles, or the weight of the body, or part itself, may be diminished as much as possible.

The natural, or rather the most easy position of the limb, is that which is usually chosen by a person who reposes himself, or who is sleeping; for then all motion is suspended, and every part assumes that posture which is most congenial to it. In this condition, the limbs are not extended, nor yet entirely bent; but only in a moderate state of flexion. Hence, Boyer remarks, that a half-bent position of the limbs, is that which is most natural, and that in which all the muscles enjoy an equal degree of relaxation, and, consequently, that it is, generally speaking, the best for fractures. This posture, as Boyer observes, which was recommended by Hippocrates and Galen, has been highly extolled by Pott, who appears to have exaggerated its advantages. Considered in a general way, it is without contradiction preferable to every other position of the limb; but its employment should be liable to exceptions, as will be noticed in treating of parti-

cular fractures. (See Boyer, *Traité des Mal. Chir.* T. 8, p. 40.)

In whatever position a broken limb is placed, (says this writer,) it should bear throughout its whole length equally and perpendicularly upon the surface on which it lies, and not be only partially supported. When, for example, only the extremities of a fractured limb rest upon the bed, the weight of the limb itself will make it bend in the situation of the fracture. The limb will also be rendered crooked, if the broken part be supported, while the extremities of the limb (especially the inferior) sink lower by their own weight. The displacement of the fracture is not the only inconvenience arising from the limb being laid upon a surface where it is not every where equally well supported. The parts which do bear on this surface, experience a painful degree of pressure, which, if long continued, is apt to produce inflammation, and even sloughing of the integuments. Thus, in fractures of the leg, gangrene of the heel has sometimes arisen entirely from this cause. Such inconveniences may be prevented by laying a fractured limb on a surface of corresponding form; that is to say, on a surface which is depressed where the limb has projections, and rises where it presents depressions. The surface should not be so hard as to annoy the patient, but yet it ought to be sufficiently firm not to yield to the weight of the limb and apparatus. According to Boyer, the best pillows for the support of broken limbs, are stuffed with chaff of oats, a substance which he describes as far preferable to feathers, because it more readily admits of being pushed from the place where the limb is prominent to another situation where the member presents a depression, or hollow; and it has the advantages of being less heating than feathers, and less apt to spoil.

In whatever position fractured limbs are placed, they ought to be kept perfectly quiet during the whole time requisite for the union. If the broken bone be moved while the callus is forming, the surfaces of the fracture rub against each other, and the process is disturbed; and, indeed, sometimes by repeatedly moving the limb, the consolidation of fractures is entirely prevented, or, at least, rendered very slow and difficult.

In order to maintain the limb in the right position, and in a state of quietude, and to preserve the fragments in proper contact with respect to each other, the surgeon is to caution the patient to avoid moving at all more than can be helped, and every cause likely to subject the limb to any kind of shock, or concussion, is to be removed. But, in particular, it will be necessary to apply a retentive apparatus, usually consisting of some application to the skin itself, bandages, splints, tapes, straps, and buckles, soft pads, &c. (See Boyer, *Traité des Mal. Chir.* T. 3, p. 42.)

Upon the subject of the dressings, bandages, &c. which ought to be applied to fractures, no surgeon has written better than Mr. Pott.

"The intention (says he) in applying any kind of external medicine to a broken limb, is, or ought to be, to repress inflammation, to disperse extravasated blood, to keep the skin lax, moist, and perspirable, and at the same time to afford some, though a very small degree of restraint or confinement to the fracture, but not to bind or press; and it should also be calculated as much as possible to prevent itching, an herpetic eruption, or an erysipelatous efflorescence. At St. Bartholomew's hospital, we use a cerate made by a solution of litharge in vinegar, which, with soap, oil, and wax, is afterward formed into such consistence as just to admit being spread without warming.

"This lies very easy, repels inflammation, is not adherent, comes off clean, and very seldom, if ever, irritates, or causes either herpes or erysipelas. But let the form and composition of the application made to the limb be what it may, one thing is clear, viz. that it should be put on in such manner, as that it may be renewed and shifted as often as may be necessary, without moving the limb in any manner: it being certain, that when once a broken thigh or leg has been properly put to rights, and has been deposited properly on the pillow, it ought not ever to be lifted up or moved from it again without necessity, until the fracture is perfectly united; and it is true, that such necessity will not very often occur."

Such application having been made as the surgeon thinks right, the next thing to be done is to put on a proper bandage.—That formerly used was what is commonly called a roller. This was of different lengths according to the surgeon's choice, or as it was used in the form of one, two, or more pieces.

"By such kind of bandage three intentions are aimed at, and said to be accomplished, viz. to confine the fracture, to repress or prevent a flux of humours, and to regulate the callus, (see *Duvernoy*;) but whoever will reflect seriously on this matter, will soon be convinced, that although some sort of bandage is necessary in every simple fracture, as well for preserving some degree of steadiness to the limb, as for the retention of the applications, yet none, nor either of these three ends can be answered merely, or even principally, by bandage of any kind whatever: and therefore, if this should be found to be true, that is, if it should appear, that whatever kind of deligation be made use of, it cannot be a principal, but only an accessory kind of assistance, and that in a small degree, and very little to be depended upon, it will follow that such kind of bandage as is most difficult to be applied with justness and exactitude, such as is soonest relaxed and out of order, such as stands most frequently in need of renewal, and, in such renewal, is most likely to give pain and trouble, must be more improper and less eligible, than one which is more easily applied, less liable to be out of order, and which can be adjusted without moving the limb, &c.

"The best and most useful bandage for a simple fracture of the leg or thigh, is what is

commonly known by the name of the eighteen-tailed bandage, or rather one made on the same principle, but with a little difference in the disposition of the pieces. The common method is to make it so, that the parts which are to surround the limb make a right angle with that which runs lengthways under it; instead of which, if they are tacked on so as to make an acute angle, they will fold over each other in an oblique direction, and thereby sit more neatly and more securely, as the parts will thereby have more connexion with and more dependence on each other. In compound fractures, as they are called, every body sees and acknowledges the utility of this kind of bandage preferably to the roller, and for very obvious and convincing reasons, but particularly because it does not become necessary to lift up and disturb the limb every time it is dressed, or every time the bandage loosens.

"The pain attending motion in a compound fracture, the circumstance of the wound, and the greater degree of instability of parts thereby produced, are certainly very good reasons for dressing such wound with a bandage which does not render motion necessary; but I should be glad to know what can make it necessary, or right, or eligible, to move a limb in the case of simple fracture? what benefit can be proposed by it? what utility can be drawn from it? When a broken bone has been well set, and the limb well placed, what possible advantage can arise from moving it? surely none; but, on the contrary, pain and probable mischief. Is it not the one great intention, to procure union? Can moving the limb every two or three days contribute to such intention? must it not, on the contrary, obstruct and retard it? Is not perfect quietude as necessary toward the union of the bone, in a simple as in a compound fracture? It is true, that in the one there is a wound which requires to be dressed, and the motion of the limb may in general be attended with rather more pain than in the other; but does motion in the simple fracture give ease, or procure more expeditious union?

"Every benefit then which can be supposed to be obtained from the use of the common bandage or roller, is equally attainable from the use of that which I have just mentioned, with one additional, and, to the patient, most invaluable advantage, viz. that of never finding it necessary to have his leg or thigh once, during the cure, removed from the pillow on which it has been properly deposited. In short, to quit reasoning and speak to fact, it is the constant practice at St. Bartholomew's, and attended with all possible success. We always use the eighteen-tailed bandage; and never move the limb to renew or adjust it." (*Pott's Remarks on Fractures, &c.*)

In France, an universal preference is given to Scultetus's bandage in every instance where we employ the eighteen-tailed one, from which it chiefly differs in being composed of separate pieces admitting of removal, so that when a part of the bandage is

soiled, it can be taken away, without disturbing the whole of the dressings. The clean pieces are first stitched to those which are about to be removed, and then they are drawn under the part. In cases of compound fracture, where the bandage is soiled with the discharge in a very short time, and must be often removed, certainly Scultetus's bandage is the best, particularly as it possesses all the recommendations peculiar to that of the eighteen-tailed kind. (*Boyer, Traité des Mal Chir. T. 3, p. 46.*)

With respect to the general objects and uses of bandages in cases of fracture, I ought to notice one design of them, which is strongly inculcated in the modern French schools: namely, that of "benumbing the irritability of the muscles" by the compression resulting from their regular and even application to the whole of the member. In describing the treatment of particular fractures, I shall have occasion to advert to the examples in which a moderate general compression of the muscles may be attended with utility.

"The parts of the general apparatus for a simple fracture, which come next in order, (observes Mr. Pott,) are the splints;" which are unquestionably the most efficient of all the applications made to a broken limb, with a view of keeping the ends of the fracture steady and in a proper state of contact. Without them, the surgeon would in vain endeavour to maintain the reduction.

"Splints," says Pott, "are generally made of pasteboard, wood, or some resisting kind of stuff, and are ordered to be applied lengthways on the broken limb; in some cases three, in others four; for the more steady and quiet detention of the fracture.

"That splints, properly made and judiciously applied, are very serviceable, is beyond all doubt; but their utility depends much on their size, and the manner in which they are applied.

"The true and proper use of splints is to preserve steadiness in the whole limb, without compressing the fracture at all. By the former they become very assistant to the curative intention; by the latter they are very capable of causing pain and other inconveniences; at the same time that they cannot, in the nature of things, contribute to the steadiness of the limb.

"In order to be of any real use at all, splints should, in the case of a broken leg, reach above the knee and below the ankle; should be only two in number, and should be so guarded with tow, rag, or cotton, that they should press only on the joints, and not at all on the fracture.

"By this they become really serviceable; but a short splint, which extends only a little above and a little below the fracture, and does not take in the two joints, is an absurdity, and, what is worse, it is a mischievous absurdity.

"By pressing on both joints, they keep not only them but the foot steady; by pressing on the fracture only, they cannot retain it in its place if the foot be in the smallest degree displaced; but they may, and fre-

quently do, occasion mischief, by rudely pressing the parts covering the fracture against the edges and inequalities of it.

"In the case of a fractured os femoris, if the limb be laid in an extended posture, one splint should certainly reach from the hip to the outer ankle, and another, (somewhat shorter) should extend from the groin to the inner ankle. In the case of a broken tibia and fibula, there never can be occasion for more than two splints, one of which should extend from above the knee to below the ankle on one side, and the other splint should do the same on the other side. (See *Remarks on Fractures and Dislocations*, in *Pott's Chirurgical Works*, Vol. 1, p. 298, &c. Edit. 1808.)

Assalini strongly disapproves of the employment of all tight bandages, and of covering the whole of a broken limb with splints. He was called to a gentleman of rank at Paris, who had broken the knee-pan transversely. He laid the limb upon a concave splint, which was adapted in shape to the under surface of a part of the leg and thigh. No bandage was used, merely two leather straps, which crossed upon the knee, and included the fractured bone. A perfect bony union was thus easily effected. Assalini afterward extended the use of a concave splint, applied under the limb, to fractures of the leg and thigh. In the first of these cases, however, only the thigh is received in the hollow splint, and from this two branches, or lateral splints, go along the leg. The apparatus has also a kind of sole for the support of the foot. As this simple contrivance is fastened with a very few straps, and no plasters or bandages are used, the surgeon has constantly a view of the whole front of the limb, and of the fractured part of it, which Assalini thinks a great advantage. In compound fractures, he puts no other dressings on the wound but linen compresses, which are kept continually wet with cold water. (*Manuale di Chirurgia, parte prima*, 1812.) For further observations on the subject, see *Splint*.

In oblique fractures of the thigh, and sometimes even in those of the leg, the difficulty of accomplishing by the ordinary means a cure free from deformity, and especially without a shortening of the limb, has led to the idea of employing continual extension. This expression implies the operation of a bandage, or machine, which continually draws the fragments of the broken bone in contrary directions, at the same time that it restrains them from gliding over each other, and maintains them in contact during the whole time necessary for their union. In England this practice has long been relinquished. It appears to have been chased away by the dazzling theory of relaxing every muscle in such manner as to render it incapable of displacing an oblique fracture; a theory with which the surgeons of this country were but too much blinded by the persuasive eloquence of the late Mr. Pott. Desault saw at once, however, every inconsistency in the doctrine of relaxing the

muscles so as to incapacitate entirely the whole set connected with a broken thigh; and he never ceased to inculcate in his school, that, in such cases, the assistance of the mechanical apparatus applied to the limb was the main thing by which the shortening of the limb was to be prevented. When we consider the treatment of fractured thighs, we shall find, that the best apparatus for these cases partly produces its good effect by continual, though moderate extension. Perhaps, also, these are the only instances in which an advantageous position will not generally do away all occasion for this method, to which many surgeons appear to entertain strong but highly exaggerated objections.

By means of continual extension, (observes Boyer) we not only succeed in uniting the fracture, while the limb preserves its natural length, but we afford the part a steadiness which is singularly favourable to the formation of the callus.

In order to derive from continual extension the utmost benefit, and render the method as little painful as possible, and supportable during the whole time of treatment, the machines and bandages, according to Boyer, should be constructed and applied conformably to the following rules.

We should avoid compressing the muscles which pass over the situation of the fracture, and the elongation of which organs is necessary to restore to the limb the length which it has lost by the gliding of the fragments over each other.

With this view, the extending power ought to be applied to that part of the limb which is articulated with the lower head of the fractured bone; and the counter-extending force to that which is articulated with the upper head. If these powers were applied to the broken bone itself, the muscles passing over the fracture would suffer such compression as would excite spasm, and render the continual extension ineffectual and even hurtful.

The extending and counter-extending force ought to be divided upon as large surfaces as possible.

The reason of this rule is obvious. The pressure of external bodies on parts is less painful in proportion as the surface pressed upon is extensive, and the operation supported at once by numerous points. On this principle, a narrow band creates stronger and more painful pressure than a broad one; and hence the rollers, and other pieces of the apparatus for making the extension and counter-extension, should be as wide as possible.

The powers, making continual extension, should act according to the direction of the axis of the broken bone.

The continual extension should be practised in as slow, gradual, and insensible a manner as possible.

The muscles easily yield to a force which stretches them, when such force acts slowly, and is very gradually increased, according to the shortness of the limb and the power

of the muscles producing the displacement. But if one were all on a sudden to begin with making violent extension, the rough forced elongation of the muscles would excite such a spasmodic action of them, as would frustrate every attempt to restore the natural length of the limb. And if, in order to fulfil this purpose the extending force were increased in a ratio to the resistance of the muscles, there would be danger of lacerating these organs, because their fibres would not have time enough to yield.

Lastly; the parts upon which the extending and counter-extending force acts should be defended; and the compression, made by the tapes or other pieces of the bandage and apparatus, ought to be equalised.

These indications may be fulfilled by covering the parts on which the tapes and bandages press, with tow or wool pads; and by filling up all the depressions of the limb with the same soft substances, so as to give it a circular form. The bandages will then not hurt the most projecting parts, on which they would make a strong and injurious degree of pressure, if the depressions were not artificially filled up.

By observing these rules, says Boyer, continual extension may always be borne even by the most delicate and irritable patients; and the important advantage will be obtained of curing the fracture, with the proper length of the limb preserved. (*Traité des Mal. Chir. T. 3, p. 56, 59.*)

8. Means for preventing and removing the unfavourable Symptoms liable to arise from Fractures.

After having reduced the fracture; applied a suitable apparatus for maintaining the reduction; and put the part in an advantageous position; the practitioner is to attend to the third indication in the treatment, viz. the prevention and removal of any unfavourable symptoms.

With the exception of a few simple fractures of the upper extremity, it is proper in all cases to allow for the first few days only very low diet, broths, tea, &c. When the patient is young and strong, and the swelling and inflammation are likely to be considerable, venesection should be practised. In other circumstances, it may in general be dispensed with, because it is well known, that for the quick formation of the callus, by which the fracture is to be united, strength and a vigorous circulation are highly favourable. The patient may be permitted to drink as often, and as much as he likes, of any cooling acid beverage. A very low diet is only to be continued the first few days, unless great inflammation arise; for experience proves that the method, when too much prolonged, has bad effects, and tends, on the same principle as bleeding, to retard the union of the fracture.

Costiveness is to be averted by the use of clysters and mild aperient medicines. It must be confessed, that, in fractures of the lower extremity, the disturbance of the limb caused by the patient's being obliged to

move himself, after taking a purgative, is seriously objectionable; but, perhaps, in all, and certainly in some habits, a neglect to open the bowels soon after the accident, would have still more pernicious consequences. In order, however, to lessen the disturbance, a bed-pan should be carefully introduced under the patient. Here, also, I feel it my duty to recommend to the notice of the profession a very complete fracture-bed invented by my friend, Mr. Earle. One great convenience of this bed, the cost of which is moderate, is to enable the patient to void his feces without the slightest change of position or disturbance; an object effected by the simple contrivance of a little kind of trap, opening under the bed, out of which a small portion of the mattress admits of being withdrawn, and a tin receptacle is placed for the reception of what is voided from the bowels and bladder. Some other advantages of this apparatus will be hereafter briefly mentioned.

With respect to external applications, we should carefully avoid using all such plasters and ointments as irritate the skin or create a disagreeable itching; for they sometimes bring on erysipelas. The emplastrum saponis in common use is the best for all simple fractures, and it is the best, rather because it does no harm than because it does any essential good. It is, generally speaking, a good plan for the first few days to wet the bandages with cold water; for in this way, the tendency to inflammation and swelling may be considerably lessened. The surgeon, however, should recollect, that the bandage shrinks when wet, and may become so tight as to do harm, if not attended to. Solutions of the acetate of lead, and other salts, make bandages stiff and hard; and as they are perhaps not more efficacious than cold water alone, the latter is sometimes preferred in cases of fracture.

When a fracture is well set, the position of the part right, and the bandage and splints neither too tight nor too slack, the less the broken bone is moved, and the less the apparatus and dressings are disturbed, the better. Sometimes, however, the practitioner is obliged to take off the splints, and undo the bandage, in order to ascertain that the ends of the fracture lie in even contact. Were he to leave the splints on the part ten days, or a fortnight, without ever being sure of this important point, he might find, when too late for alteration, that the fracture was in a state of displacement, and the limb seriously deformed. Hence a strong reason for employing the eighteen-tailed bandage, which admits of being opened without disturbing the limb, or even without lifting it from the surface upon which it has been deposited.

In fractures of the lower extremities, particularly of the legs, it sometimes happens, the first two or three nights after the reduction, that the limb is affected with convulsive spasms and cramps, which make the patient start out of his sleep, and displace the

ends of the bone, which must be again reduced.

When the callus has acquired some firmness, the patient should still keep the part or limb quiet, until the union is perfectly consolidated. And, in fractures of the lower extremity, even after the union has proceeded so far, that the splints admit of being left off, the patient ought not to venture to get out of bed, or bear upon the limb, till several more days have elapsed.

All fractures, however simple and well treated they may be, are constantly followed by weakness and stiffness of the limb. These unpleasant consequences are the greater, the more violently the limb has been contused, the nearer the fracture is to a joint, and the longer the part has remained motionless, and without exercise. The stiffness always affects the inferior joint of the broken bone, much more than the superior. For the relief of these effects of fractures, it is customary to employ friction, liniments, emollient relaxing applications, cold washes and bathing; but, sometimes, notwithstanding such remedies, the member does not quickly recover its strength, but continues stiff and weak for a year, or even a longer time. The most effectual plans for the prevention of this state should therefore be resorted to early. These consist in making the joints, nearest the fracture, execute slight motions, as soon as the union is sufficiently advanced, not to be in danger of interruption from this practice. A great deal of caution, however, is necessary in moving the part, and it is safer for the surgeon to superintend the business himself, than leave it to the patient or others. One of the best proceedings also for the hinderance of much weakness and stiffness in the limb after a fracture, is to discontinue the splints and tight bandages, immediately the state of the callus will allow. The manner, in which their pressure retards the circulation, and prevents the action of the muscles, is one of the principal causes of the stiffness of the limb, and, consequently, the sooner they can be safely left off, the sooner will the patient regain the free use of the limb.

In France, the chief division of fractures is into *simple* and *complicated*, which last includes among many varieties the cases, which we name *compound*. We shall here briefly notice a few of the complications, and the particular treatment which they require.

Fractures (says Boyer) are always attended with a certain degree of contusion, which is constantly more severe in cases where the violence has acted directly on the situation of the fracture. But, such contusion can only be regarded as a complication of the accident, when it exists in so violent a degree as to demand a different treatment from that which is employed in simple fractures.

In this circumstance, the splints and bandage should be applied rather slackly, and the latter ought to be wet with cold water, or some resolvent lotion. The patient is to

be bled more or less freely, according to his age, the state of his constitution, and violence of the contusion. The next day, the splints and bandage should be opened; a thing highly necessary to be observed; for, where it has been neglected, the limb has been known to mortify, in consequence of the swelling having rendered the bandage too tight, so that the circulation was impeded. (*Boyer, Traité des Mal. Chir. T. 3, p. 63—64.*)

In cases where the contusion is very great, but unattended with a wound of the integuments, the tension and swelling may be so intense, that the cuticle is detached, forming vesicles filled with yellowish serum. These vesicles may deceive an inexperienced surgeon, and lead him to imagine that the limb is threatened or actually affected with gangrene. They ought to be punctured, and covered with pledgets of simple ointment. Here some practitioners apply emollient poultices under the apparatus; but, there is some inconvenience in their use, and it may be questioned, whether cold lotions are not generally better.

In simple fractures, it does not often happen, that a large artery is wounded; but, when the injury does occur, and a diffused aneurism takes place, the surgeon is to expose the vessel by an incision, and apply a ligature above and below the opening. We are to be careful, however, before resorting to the operation, that the tumour is not a venous extravasation, which may almost always be dissipated by resolvent applications.

Fractures are sometimes complicated with a dislocation. Here, if possible, the luxation should invariably be reduced before the fracture is set. The possibility of reducing the dislocation (says Boyer) depends upon the species of articulation, the situation of the fracture, and other circumstances of the case. When it is a ginglymoid joint, when the ligaments are lacerated, and the swelling is not considerable, the luxation may be reduced easily enough; but, when it is an orbicular joint, surrounded by numerous muscles; and when the fracture is near the articulation, and situated below the dislocation; the reduction of the latter is impossible. The attempt indeed would be injurious, because the necessary extension could not act upon the upper fragment, and were it to operate upon the lower, it could only have the effect of painfully stretching the muscles, and perhaps lacerating them. The fracture, therefore, should be at first attended to, and after its firm union, an endeavour may be made to rectify the dislocation. Boyer conceives, that there will be more probability of success, when care is taken to move the limb gently, as soon as the state of the callus will permit it. He also recommends the employment of emollient relaxing applications. He confesses, however, that the attempt rarely succeeds after the perfect union of the fracture. There are, it is true, examples, in which old dislocations may be reduced; but, these are cases, which

are not complicated with a fracture, an accident, which always renders the muscles and ligaments so stiff, that they cannot yield to the extension requisite for the reduction. "I do not know, (says Boyer,) that a luxation, complicated with fracture, has ever been reduced, when the nature of the joint, and the circumstances of the case, prevented the treatment from beginning with the reduction of dislocation." (*Traité des Mal. Chir.* T. 3, p. 79.)

COMPOUND FRACTURES.

What Mr. Pott has said upon these cases is, with one or two exceptions, to which I shall advert, the essence of good surgery, not in the least deteriorated, as a few other parts of his precepts have been, by the more mature instructions of time and experience, or by that growing state of surgical science, which, fostered by genius and observation, is continually bringing to light new facts.

"In a compound fracture," says Mr. Pott, "the first object of consideration is, whether the preservation of the fractured limb can, with safety to the patient's life, be attempted; or, in other words, whether the probable chance of destruction, from the nature and circumstances of the accident, is not greater than it would be from the operation of amputation. Many things may occur to make this the case. The bone, or bones, being broken into many different pieces, and that for a considerable extent, as happens from broad wheels, or other heavy bodies of large surface, passing over, or falling on such limbs; the skin, muscles, tendons, &c. being so torn, lacerated, and destroyed, as to render gangrene and mortification the most probable and most immediate consequence; the extremities of the bones forming a joint being crushed, or as it were comminuted, and the ligaments, connecting such bones, being torn and spoiled, are, among others, sufficient reasons for proposing and for performing immediate amputation. Reasons, which (notwithstanding any thing that may have been said to the contrary) long and reiterated experience has approved, and which are vindicable upon every principle of humanity, or chirurgic knowledge.

"When a surgeon says, that a limb, which has just suffered a particular kind of compound fracture, ought rather to be cut off, than that any attempt should be made for its preservation, he does not mean by so saying, that it is absolutely impossible for such limb to be preserved at all events; he is not to be supposed to mean so much in general, though sometimes even that will be obvious; all that he can truly and justly mean is, that from the experience of time it has been found, that the attempts to preserve limbs so circumstanced, have most frequently been frustrated by the death of the patients, in consequence of such injury; and that from the same experience it has been found, that the chance of death from amputation is by no means equal to that arising from such kind of fracture.

"Every man knows, that apparently desperate cases are sometimes cured; and that limbs so shattered and wounded, as to render amputation the only *probable* means for the preservation of life, are now and then saved. This is an uncontroverted fact, but a fact which proves very little against the common opinion; because every man of experience also knows, that such escapes are very rare, much too rare to admit of being made precedents, and that the majority of such attempts fail.

"This consideration relative to amputation is of the more importance, because it most frequently requires immediate determination; every minute of delay is, in many instances, to the patient's disadvantage; and every short space of time indeed, frequently makes all the difference between probable safety and fatality. If these cases in general would admit of deliberation for two or three days, and during that time such circumstances might be expected to arise, as ought necessarily to determine the surgeon in his conduct, without adding to the patient's hazard, the difference would be considerable; the former would not seem to be so precipitate in his determination, as he is frequently thought to be; and the latter, being more convinced of the necessity, would submit to it with less reluctance. But, unhappily for both parties, this is seldom the case; and the first opportunity having been neglected or not embraced, we are frequently denied another. Here therefore, the whole exertion of a man's judgment is required, that he may neither rashly and unnecessarily deprive his patient of a limb, nor, through a false tenderness and timidity, suffer him to perish, by endeavouring to preserve such limb. Some degree of address is also necessary upon such occasions, in order to convince the patient, that what seems to be determined upon hastily and with precipitation, will not safely admit of longer deliberation.

"The limb being thought capable of preservation, the next consideration is the reduction of the fracture. The ease or difficulty attending this, depends not only on the general nature of the case, but on the particular disposition of the bone with regard to the wound.

"If the bone be not protruded forth, the trouble of reducing and of placing the fracture in a good position, will be much less than if the case be otherwise: and in the case of protrusion or thrusting forth of the bone or bones, the difficulty is always in proportion to the comparative size of the wound, through which such bone has passed. In a compound fracture of the leg or thigh, it is always the upper part of the broken bone, which is thrust forth. If the fracture be of the transverse kind, and the wound large, a moderate degree of extension will in general easily reduce it; but if the fracture be oblique, and terminates, as it often does, in a long sharp point, this point very often makes its way through a wound no longer than just to permit such extension.

In this case, the very placing the leg in a straight position, in order to make extension, obliges the wound or orifice to gird the bone tight, and makes all that part of it, which is out of such wound, press hard on the skin of the leg underneath it. In these circumstances, all attempts for reduction in this manner will be found to be impracticable; the more the leg is stretched out, the tighter the bone will be begirt by the wound, and the more it will press on the skin underneath.

"Upon this occasion, it is not very unusual to have recourse to the saw, and by that means to remove a portion of the protruded bone.

"I will not say that this is always or absolutely unnecessary or wrong, but it most certainly is frequently so. In some few instances, and in the case of extreme sharp-pointedness of the extremity of the bone, it may be, and undoubtedly is right: but, in many instances, it is totally unnecessary.

"The two most proper means of overcoming this difficulty are, change of posture of the limb, and enlargement of the wound. In many cases, the former of these, under proper conduct, will be found fully sufficient; and where it fails, the latter should always be made use of. Whoever will attend to the effect, which putting the leg or thigh (having a compound fracture and protruded bone) into a straight position always produces; that is, to the manner in which the wound in such position girds the bone, and to the increased difficulty of reduction thereby induced, and will then, by changing the posture of such limb from an extended one, to one moderately bent, observe the alteration thereby made, in both the just-mentioned circumstances, will be satisfied of the truth of what I have said, and of the much greater degree of ease and practicability of reduction in the bent, than in the extended position; that is, in the relaxed than in the stretched state of the muscles." Reduction being found impracticable, either by extension or change of posture, Mr. Pott recommends an enlargement of the wound.

"If the bone be broken into several pieces, and any of them be either totally separated, so as to lie loose in the wound, or if they be so loosened and detached, as to render their union highly improbable, all such pieces ought to be taken away; but they should be removed with all possible gentleness, without pain, violence, or laceration, without the risk of hemorrhage, and with as little poking into the wound as possible. If the extremities of the bone be broken into sharp points, which points wound and irritate the surrounding parts, they must be removed also. But the whole of this part of the treatment of a compound fracture should be executed with great caution; and the practitioner should remember, that if the parts surrounding the fracture be violated, that is, be torn, irritated, and so disturbed as to excite great pain, high inflammation, &c. it is exactly the same thing to the patient, and to the event of the case, whether such violence be the

necessary consequence of the fracture, or of the unnecessary, and awkward manner of poking into, and disturbing the wound. The great objects of fear and apprehension in a compound fracture, (that is, in the first or early state of it) are pain, irritation, and inflammation; these are to be avoided, prevented, and appeased by all possible means, let every thing else be as it may be; and although certain things are always recited, as necessary to be done, such as removal of fragments of bone, of foreign bodies, &c. &c. yet it is always to be understood, that such acts may be performed without prejudicial or great violence, and without adding at all to the risk or hazard necessarily incurred by the disease.

"Reduction of, or setting a compound fracture, is the same as in the simple; that is, the intention in both is the same, viz. by means of a proper degree of extension to obtain as apt a position of the ends of the fracture, with regard to each other, as the nature of the case will admit, and thereby to produce as perfect and as speedy union as possible.

"To repeat in this place what has already been said under the head of Extension would be tedious and unnecessary. If the arguments there used for making extension with the limb so moderately bent as to relax the muscles, and take off their power of resistance, have any force at all, they must have much more when applied to the present case; if it be allowed to be found very painful to extend, or to put or to keep on the stretch, muscles which are not at all, or but slightly wounded, and only liable in such extension to be pricked and irritated, it is self-evident, that it must be much more so when the same parts are torn and wounded." After a few additional observations, in praise of the good effects of relaxing the muscles, Mr. Pott proceeds:—

"The wound dilated, (if necessary) loose pieces removed, (if there were any) and the fracture reduced in the best possible position, the next thing to be done is to apply a dressing."

When Mr. Pott wrote on this subject, the plan of bringing the edges of the wound together with adhesive plaster, in cases of compound fracture, had not been established; and the advantage of this mode of dressing in the first instance was not duly known. I do not mean the practice of drawing the edges of the wound forcibly together with strips of plaster, nor of encircling and compressing the part with the same; but only the method of applying two or three short pieces of plaster, so as lightly and gently to retain the opposite sides of the wound in contact, and afford them an opportunity of uniting by the first intention. Now, although such attempt will frequently fail, on account of the wound being generally in a contused, irregular, and lacerated state, the chance of success should be taken, because the experiment at all events will occasion no harm, and if it answer, it will change the case at once from a fracture with an open wound to

one, which has no external communication, or, as might almost be said, from a compound into a simple fracture. Some of the following directions, therefore, given by Mr. Pott, I consider in the present state of surgery as only applicable when the wound has suppurated.

"The dressing necessary in a compound fracture, is of two kinds, viz. that for the wound, and that for the limb. By the former, we mean to maintain a proper opening for the easy and free discharge of gleet, sloughs, matter, extraneous bodies, or fragments of bone, and this in such manner, and by such means, as shall give the least possible pain or fatigue, shall neither irritate by its qualities, nor oppress by its quantity, nor by any means contribute to the detention or lodgment of what ought to be discharged. By the latter, our aim should be the prevention or removal of inflammation, in order, if the habit be good, and all other circumstances fortunate, that the wound may be healed, by what surgeons call the first intention, that is, without suppuration or abscess; or, that not being practicable, that gangrene and mortification, or even very large suppuration may be prevented, and such a moderate and kindly degree of it established as may best serve the purpose of a cure. The first, therefore, or the dressing for the wound, can consist of nothing better, or indeed so good, as soft dry lint, laid on so lightly as just to absorb the sanies, but neither to distend the wound, or be the smallest impediment or obstruction to the discharge of matter. This lint should be kept clear of the edges, and the whole of it should be covered with a pledget spread with a soft easy digestive. The times of dressing must be determined by the nature of the case; if the discharge be small or moderate, once in twenty-four hours will be sufficient; but if it be large, more frequent dressing will be necessary, as well to prevent offence, as to remedy the inconveniences arising from a great discharge of an irritating sharp sanies.

"The method of treating the limb, with a view to the prevention of such accidents and symptoms, as pain, inflammation, and laceration of parts, are likely to produce, is different with different practitioners; some using from the very first, relaxing, greasy applications; others applying medicines of very different nature. Both these may be right conditionally, that is, according to different circumstances in the case, but they cannot be equally so in the same circumstances.

"When from neglect, from length of time passed without assistance, from misconduct or drunkenness in the patient, from awkwardness and unhandiness in the assistants, or from any other cause, a tension has taken possession of the limb, and it is become tumid, swollen, and painful, Mr. Pott admits, that a warm cataplasm is the most proper application that can be made: immediate union is impossible, and every thing which can tend toward relaxing the tense, swollen, and irritable state of the parts concerned,

must necessarily be right. But when the parts are not in this state, the intention seems to be very different. To relax swollen parts, and to appease pain and irritation by such relaxation, is one thing; to prevent inflammatory effluxion and tumefaction, is certainly another; and they ought to be aimed at by very different means. In the former, a large suppuration is a necessary circumstance of relief, and the great means of cure; in the latter it is not, and a very moderate degree of it is all that is required. The warm cataplasm, therefore, although it be the best application that can be made use of in the one case, is certainly not so proper in the other, as applications of a more discutient kind, such as mixtures of spirit, vini, vinegar and water, with the muriate of ammonia, liquor ammoniæ acetatæ, liquor plumbi acetatis, and medicines of this class, in whatever form the surgeon may choose. By these, in good habits, in fortunately circumstanced cases, and with the assistance of what should never be neglected, (I mean phlebotomy* and the general antiphlogistic regimen,) inflammation may sometimes be kept off, and a cure accomplished, without large collections or discharges of matter, or that considerable degree of suppuration, which though necessary in some cases, and almost unavoidable in others, are and must be rather promoted and encouraged, than retarded, or prevented, by warm relaxing applications of the poultice kind.

"Compound fractures in general require to be dressed every day; and the wounded parts not admitting the smallest degree of motion without great pain, perfect quietude becomes as necessary as frequent dressing.

"The common bandage therefore (the roller) has always in this case been laid aside, and what is called the eighteen-tailed bandage substituted very judiciously in its place.

"Splints of proper length, which reach from joint to joint, comprehend them both, and are applied on each side of the leg only, are very useful both in the simple and in the compound fracture, as they may, thus applied, be made to keep the limb more constantly steady and quiet than it can be kept without them."

Mr. Pott then enters into the consideration of the posture of the limb, which "is so principal a circumstance, that without its concurrence every other will be fruitless. The points to be aimed at are, the even position of the broken parts of the bone, and such disposition of the muscles surrounding them, as is most suitable to their wounded, lacerated state, as shall be least likely to irritate them, by keeping them on the stretch, or to produce high inflammation, and at best large suppuration."

According to Mr. Pott, these cases, of all others, require at first the most rigid observance of the antiphlogistic regimen; pain is to be appeased, and rest obtained, by ano

* At present, bleeding is not frequently practised except on young plethoric persons, and out of large cities.

dynes; inflammation is to be prevented or removed, by bleeding and aperient medicines. And during the first state or stage, the treatment of the limb must be calculated, either for the prevention of inflammatory tumefaction, by discutients; or, such tumour and tension having already taken possession of the limb, warm fomentation, and relaxing and emollient medicines are required.

"If these, according to the particular exigence of the case, prove successful, the consequence is, either a quiet easy wound, which suppurates very moderately, and gives little or no trouble; or a wound, attended at first with considerable inflammation, and that producing large suppuration, with great discharge, and troublesome formation and lodgment of matter. If, on the other hand, our attempts do not succeed, the consequence is gangrene and mortification.

"These are the three general events or terminations of a compound fracture; and according to these must the surgeon's conduct be regulated.

"In the first instance, he has indeed nothing to do but to avoid doing mischief, either by his manner of dressing, or by disturbing the limb. Nature let alone, will accomplish her own purpose; and art has little more to do than to preserve the due position of the limb, and to take care that the dressing applied to the wound proves no impediment.

"In the second stage, that of formation and lodgment of matter, in consequence of large suppuration, all a surgeon's judgment will sometimes be required in the treatment both of the patient and his injured limb. Enlargement of the present wound, for the more convenient discharge of matter: * new or counter-openings for the same purpose, or for the extraction of fragments of broken or exfoliated bone, will very frequently be found necessary, and must be executed. In the doing this, care must be taken, that what is requisite be done, and no more; and that such requisite operations be performed with as little disturbance and pain as possible.

Previous to large suppuration, or considerable collections and lodgments of matter, evacuation by phlebotomy, an open belly, and antiphlogistic remedies, as well as the free use of anodynes, and such applications to the limb as may most serve the purpose of relaxation, are the remedies, which Mr. Pott advises for the relief of the swelling, induration, and high inflammation, attended with pain, irritation, and fever. "But the matter having been formed and let out, and the pain, fever, &c. which were symptomatic thereof, having disappeared, or ceased, the use and purpose of such medicines and such

applications cease also, and they ought therefore to be discontinued. By evacuation, &c. the patient's strength has necessarily (and indeed properly) been reduced; by cataplasm, &c. the parts have been so relaxed as to procure an abatement or cessation of inflammation, a subsidence of tumefaction, and the establishment of a free suppuration; but these ends once fairly and fully answered, another intention arises, which regards the safety and well-doing of the patient nearly, if not full as much as the former; which intention will be necessarily frustrated by pursuing the method hitherto followed. The patient now will require refection and support, as much as he before stood in need of reduction; and the limb, whose indurated and inflamed state hitherto required the emollient and relaxing poultice, will now be hurt by such kind of application, and stand in need of such as are endued with contrary qualities, or, at least, such as shall not continue to relax. Good, light, easily digested nutriment, and the Peruvian bark, will best answer the purpose of internals; the discontinuation of the cataplasms, and the application of medicines of the corroborating kind, are as necessary with regard to externals."

"Every body who is acquainted with surgery knows (says Mr. Pott) that, in the case of bad compound fracture, attended with large suppuration it sometimes happens, even under the best and most judicious treatment, that the discharge becomes too great for the patient to sustain; and that, after all the fatigue, pain, and discipline, which he has undergone, it becomes necessary to compound for life by the loss of the limb. This, I say, does sometimes happen under the best and most rational treatment; but I am convinced that it also is now and then the consequence of pursuing the reducing, the antiphlogistic, and the relaxing plan too far. I would therefore take the liberty seriously to advise the young practitioner to attend diligently to his patient's pulse and general state, as well as to that of his fractured limb and wound; and when he finds all febrile complaint at an end, and all inflammatory tumour and hardness gone, and his patient is rather languid than feverish, that his pulse is rather weak and low than hard and full, that his appetite begins to fail, and that he is inclined to sweat, or purge, without assignable cause; and this in consequence of a large discharge of matter from a limb which has suffered great inflammation, but which is now become rather soft and flabby, than

* "It is a practice with some, from a timidity in using a knife, to make use of bolsters and plaster-compresses for the discharge of lodging matter. Where another, or a counter-opening can conveniently and safely be made, it is always preferable, the compress sometimes acting diametrically opposite to the intention with which it is applied, and contributing to the lodgment by confining the matter; besides which, it requires a great degree of pressure to make it efficacious, than a limb in such circumstances generally can bear."

* "It is surprising how large and how disagreeable a discharge will be made for a considerable length of time, in some instances, from the detention and irritation of a splinter of bone. If therefore such discharge be made, and there be neither sinus nor lodgment to account for it, and all other circumstances are favourable, examination should always be made, in order to know whether such cause does not exist, and if it does, it must be gently and carefully removed."

† After the bones had united, Mr. Pott never found it necessary to amputate a limb for a compound fracture, on account of the too great discharge.

hard and tumid; that he will in such circumstances set about the support of his patient, and the strengthening of the diseased limb *totis viribus*; in which I am from experience satisfied, he may often be successful, where it may not be generally expected that he would. At least, he will have the satisfaction of having made a rational attempt; and if he is obliged at last to have recourse to amputation, he will perform it, and his patient will submit to it, with less reluctance, than if no such trial had been made."

According to Mr. Pott, gangrene and mortification are sometimes the inevitable consequences of the mischief done to the limb at the time that the bone is broken; or they are the consequences of the laceration of parts, made by the mere protrusion of the said bone. They are also sometimes the effect of improper or negligent treatment; of great violence used in making extension; of irritation of the wounded parts by poking after, or in removing fragments or splinters of bone; of painful dressings; of improper disposition of the limb, and of the neglect of phlebotomy, anodynes, evacuation, &c.

"When such accident, or such disease, is the mere consequence of the injury done to the limb, either at the time of, or by the fracture, it generally makes its appearance very early; in which case also, its progress is generally too rapid for art to check. For these reasons, when the mischief seems to be of such nature that gangrene and mortification are most likely to ensue, no time can be spared, and the impending mischief must either be submitted to or prevented by early amputation. I have already said, that a very few hours make all the difference between probable safety and destruction. If we wait till the disease has taken possession of the limb, even in the smallest degree, the operation will serve no purpose but that of accelerating the patient's death. If we wait for an apparent alteration in the part, we shall have waited until all opportunity of being really serviceable is past. The disease takes possession of the cellular membrane surrounding the large blood-vessels and nerves, some time before it makes any appearance in the integuments; and will always be found to extend much higher in the former part, than its appearance in the latter seems to indicate. I have more than once seen the experiment made of amputating, after a gangrene has been begun, but I never saw it succeed; it has always hastened the patient's destruction."

"As far therefore as my experience will

enable me to judge, or as I may from thence be permitted to dictate, I would advise that such attempt should never be made; but, the first opportunity having been neglected, or not embraced, all the power of the chirurgic art is to be employed in assisting nature to separate the diseased part from the sound; an attempt which now and then, under particular circumstances, has proved successful, but which is so rarely so, as not to be much depended upon.

"If the parts are so bruised and torn, that the circulation through them is rendered impracticable, or if the gangrene is the immediate effect of such mischief, the consequence of omitting amputation, and of attempting to save the limb is, as I have already observed: most frequently very early destruction: but, if the gangrenous mischief be not merely and immediately the effect of the wounded state of the parts, but of high inflammation, badness of general habit, improper disposition of the limb, &c. it is sometimes in our power so to alleviate, correct, and alter these causes, as to obtain a truce with the disease, and a separation of the unsound parts from the sound. The means whereby to accomplish this end must, in the nature of things, be varied according to the producing causes or circumstances: the sanguine and bilious must be lowered and emptied; the weak and debilitated must be assisted by such medicines as will add force to the *vis vitæ*; and errors in the treatment of the wound or fracture must be corrected; but it is evident to common sense, that for these there is no possibility of prescribing any other than very general rules indeed. The nature and circumstances of each individual case must determine the practitioner's conduct.

"In general, inflammation will require phlebotomy and an open belly, together with the neutral antiphlogistic medicines; pain and irritation will stand in need of anodynes, and the Peruvian bark, joined, in some cases and at some times, with those of the cooling kind, at others with the cordial, will be found necessary and useful. So also tension and induration will point out the use of fomentation and warm relaxing cataplasms, and the most soft and lenient treatment and dressing."

Mr. Pott then offers many just observations against stimulating antiseptic applications to the wound and scarification of the limb, as practised while the gangrene is forming. The custom of using stimulating dressings to bad compound fractures first began in cases produced by gunshot, and had its foundation in the opinion, that gunshot wounds were poisonous, and that the mortification in them was the effect of fire; a doctrine and practice now completely exploded. "A gunshot wound (says Pott) whether with or without a fracture, is a wound accompanied with the highest degree of contusion, and with some degree of laceration; and every greatly contused and lacerated wound requires the same kind of treatment which a gunshot wound does.

* In the article *Gunshot Wounds*, however, the reader will find, that there is a species of gangrene, arising from external violence, and totally unconnected with constitutional causes, where the surgeon should deviate from the common rule of deferring amputation, until the mortification has ceased to spread. A memoir "*Sur la Gangrène Traumatique*," which was published a few years ago by Baron Larrey, contains the most decisive facts in regard to the propriety of such practice. (See his *Mém. de Chir. Militaire*, T. 2.) And the experience of Mr. Lawrence tends also to confirm the truth of Larrey's Observations. (See *Méd. Chir. Trans.* Vol. 6, p. 184, &c.)

as far as regards the soft parts. The intention in both ought to be to appease pain, irritation, and inflammation."

"Scarification, in the manner, and at the time, in which it is generally ordered and performed, has never appeared to me to have served any one good purpose. When the parts are really mortified, incisions made of sufficient depth will give discharge to a quantity of acrid and offensive ichor; will let out the confined air, which is the effect of putrefaction: and thereby will contribute to unloading the whole limb; and they will also make way for the application of proper dressings. But while a gangrene is impending, that is, while the parts are in the highest state of inflammation, what the benefit can be which is supposed or expected to proceed from scratching the surface of the skin with a lancet, I never could imagine; nor, though I have often seen it practised, do I remember ever to have seen any real benefit from it. If the skin be still sound, and of quick sensation, the scratching it in this superficial manner is painful, and adds to the inflamed state of it; if it be not sound, but quite altered, such superficial incision can do no possible service; both the sanies and the imprisoned air are beneath the *membrana adiposa*; and merely scratching the skin in the superficial manner, in which it is generally done, will not reach to, or discharge either.

"From what has been said, it will appear, that there are three points of time, or three stages, of a bad compound fracture, in which amputation of the limb may be necessary and right; and these three points of time are so limited, that a good deal of the hazard or safety of the operation depends on the observance or nonobservance of them.

"The first is immediately after the accident, before inflammation has taken possession of the parts. If this opportunity be neglected or not embraced, the consequence is either a gangrene or a large suppuration, with formation and lodgment of matter. If the former of these be the case, the operation ought never to be thought of, till there is a perfect and absolute separation of the mortified parts.* If the latter, no man can possibly propose the removal of a limb, until it be found, by sufficient trial, that there is no prospect of obtaining a cure without; and that, by not performing the operation, the patient's strength and life will be exhausted by the discharge. When this becomes the hazard, the sooner amputation is performed the better. In the first instance, the operation ought to take place before inflammatory mischief is incurred; in the second we are to wait for a kind of crisis of

such inflammation; in the third, the proportional strength and state of the patient, compared with the discharge and state of the fracture, must form our determination." (*Pott's Remarks on Fractures*.)

6. *Of the Formation of Callus, the Consolidation of Fractures, and of the Cases in which they remain without Union.*

In the treatment of fractures, the whole business of the surgeon consists in putting the displaced extremities of the bone into their natural situation again; in keeping them in this situation by means of a suitable apparatus; in endeavouring to avert unfavourable symptoms, and in adopting measures for their removal, when they have actually occurred. The consolidation of a broken bone is (strictly speaking) the work of nature, and is effected by a process, to which a state of perfect health is above all things propitious.

This consolidation of a broken bone, which is analogous to the union of wounds of the soft parts, is termed the *formation of the callus*, and the new uniting bony substance itself is named *callus*.

1. *Of the Time requisite for the Formation of the Callus, and of general circumstances, which favour, retard, or even completely prevent it.*

Surgical writers have been absurdly anxious to specify a determinate space of time, which should be allowed for the formation of the callus, as if this process always went on in different cases with the same uninterrupted regularity. Forty days were often fixed upon as necessary for the purpose. This prejudice is not only false, but dangerous, inasmuch as patients have been thereby induced to suppose themselves cured, before they were so in reality, and have consequently moved about too boldly, and thus run the risk of occasioning deformity, or a new fracture. As Boyer observes, it is impossible to determine precisely, and in a general way, the period requisite for the cure, because it differs according to a variety of circumstances. All we know is, that the callus is usually formed between the twentieth and seventieth day, sooner or later, according to the age and constitution of the patient, the thickness of the bone, the weight which it has to support, the state of the patient's health, &c.

1. *Age.* Fractures are consolidated (*ceteris paribus*) with more ease and quickness in young subjects, than in adults, or old persons. In general, also, the callus forms more speedily in proportion as the individual approaches to infancy. In two children, whose arms had been broken in difficult labours, De la Motte saw the humerus united in twelve days, by a very simple apparatus. In fact, at this period of life, every part has a tendency to grow and develop itself, and the vitality of the bones is more active, their vascularity greater, their gelatinous substance more abundant. On the contrary, in advanced age, the parts have lost all disposition to development, the vascularity of the bones

* Compound fractures are cases of external violence. Now as the mortification proceeds from the injury, and may not be connected with any internal cause, it is an example of what Larrey calls the "*Gangrene Traumatique*," and the question whether the surgeon ought to be governed by the old maxim of delaying amputation, until the spreading of the mortification has ceased, yet remains unsettled. Were the patient of a sound constitution, and not too far gone, I should not fear to imitate Larrey, and amputate though the mortification were actually in a spreading state.

is in a great measure obliterated, and (to use the expression of Boyer) their vitality is annihilated under the mass of phosphate of lime, which accumulates in them.

It has been asserted, that in early infancy the callus is generally produced in excess, and may cause deformity by its redundancy. But experience does not confirm the truth of this statement. The real cause of deformity always proceeds from the fracture either being badly set, or not kept properly reduced, or else from the part being moved about before the callus has acquired a due degree of firmness.

2. *Constitution.* A fracture is united much sooner in a strong healthy person, than a weak unhealthy subject. Sometimes, the consolidation is prevented by some inexplicable unknown cause, nothing wrong being remarkable either in the constitution or the part. Ruysch and Van Swieten met with several cases of this kind, in which the patients were apparently quite healthy and judiciously treated.

3. *Thickness of the Bone, and weight which it has to support.* The bones are thicker and larger in proportion as they have a greater weight to bear, and as the muscles inserted into them are more powerful. It is observed, *ceteris paribus*, that the larger the bones are, the longer is the time requisite for their union. Thus a broken thigh-bone is longer in growing together again, than a fractured tibia; the tibia longer than the humerus, the bones of the fore-arm, clavicle, ribs, &c.

As the callus remains a good while softer than the rest of the bone, it follows that if the newly united bone has to bear all the weight of the body in walking, the patient should defer this exercise longer. Hence, one reason why fractures of the arm are sooner cured than those of the tibia, and why six or seven weeks at least are necessary in the treatment of a broken thigh-bone, which of itself has to support in progression all the weight of the trunk.

4. *State of Health.* Fractures unite with more quickness and facility when the patient enjoys good health. The scurvy has a manifest and powerful effect in retarding the consolidation of fractures, and even in causing the absorption of the callus several years after its formation, so that a bone becomes flexible again at the point where it was formerly broken. In Lord Anson's Voyage, this phenomenon is particularly recorded. (See p. 142, *Edit. 15 in 8vo.*) Langenbeck is acquainted with several cases, in which the callus at the end of eight weeks became again soft; and the bone flexible, in consequence of the patients being attacked with fevers, or erysipelas. (*Neue Bibl. B. 1, P. 90.*) Cancer, lues venerea, and rickets, are also stated by surgical writers to obstruct and sometimes hinder altogether the formation of callus.

Fabricius Hildanus has cited two cases, which tend to prove that the union of fractures is retarded by pregnancy. (*Cent. 5. Obs. 87. Cent. 6. Obs. 68.*) Alanson has also related a case, in which the union, which

had been delayed during pregnancy, took place after delivery; (*Med. Obs. and Inq. Vol. 4, No. 37.*) and Werner has published an account of a fracture of the radius in a pregnant woman, where the cure was apparently retarded for a long time by this circumstance, and though the union took place previously to delivery, the callus was not very firm till after that event. (*Richter, Bibl. B. 11, P. 591.*) From the facts, however, mentioned in a preceding page of this article, there can now be no doubt, that pregnancy frequently does not prevent the formation of callus in the ordinary time, though the observation of Mr. Wardrop is true, that many instances have been observed of bones being fractured during pregnancy, and never showing any disposition to unite till after delivery. (*Med. Chir. Trans. Vol. 5, p. 359.*)

Besides the remarks made here and in a foregoing page on the causes preventing the union of fractures, a few additional observations on the same subject will be introduced in the sequel of this article, when we speak of the modes of attempting the cure of old disunited fractures.

2. Of some local Circumstances necessary for the Consolidation of Fractures.

As Boyer has well explained, three local circumstances are necessary to obtain a firm callus, without deformity. 1. The two fragments must be possessed of sufficient vascularity. 2. The surfaces of the fracture must correspond. 3. They must be kept in a completely motionless state.

The two fragments must be sufficiently vascular. If one of them should be too scantily supplied with blood, the fracture would be incapable of union. This (says Boyer) is what happens in certain fractures of the neck of the femur, where the head of this bone is entirely detached, and the ligamentous substance, which is reflected over its neck, and serves as its periosteum, is totally lacerated, as well as the vessels which ramify upon it. Hence, the upper fragment lodged in the cotyloid cavity no longer receives from the vessels sent to it through the ligamentum teres, a sufficiency of blood for the process of the formation of callus. This is especially likely to be the case, when the patient is far advanced in years, and the vessels considerably lessened in diameter. An adequate circulation must therefore exist in both portions of bone; for without it the attempt at union will fail.

The surfaces of the fracture must correspond exactly. This circumstance is not absolutely necessary for the consolidation of the fracture; but without it, the formation of the callus is always slow and difficult. For instance, in a transverse fracture of the thigh-bone, the fragments after being displaced according to the thickness of the bone, may undergo a second displacement according to its length, by passing beyond each other. The surfaces of the fracture are then not at all in contact, and the portions of bone only touch each other by their sides, which being covered by the periosteum, can

unite but difficultly. Here, at the end of the second month, the union will frequently have made but little progress; nor can the cure be accomplished without deformity and shortening of the limb.

The fragments must be retained in a completely motionless state. This condition is so essential to the formation of callus, that if the ends of a fracture were daily moved, they could not unite. The two extremities of the bone would then heal separately, just like the sides of a wound which have not been put in contact. The ends of a fracture, however, which cicatrize separately, do not (according to Boyer) always become smooth, nor is there ordinarily any capsular ligament formed. (*Traité des Mal. Chir. T. 3, p. 86.*)

3. Different Opinions on the Formation of Callus.

As Boyer remarks, perhaps no subject has excited more discussion, than the formation of callus. The ancients ascribed it to the extravasation of a gelatinous fluid, which was called the osseous juice, and which becoming hard, served to unite the ends of the broken bone, just as glue serves to unite two pieces of wood. Hence, in order to favour the production of callus, they were in the habit of recommending their patients to eat abundantly of every sort of viscid farinaceous aliment, the glutinous parts of animals, and especially osteocolla, of which Fabricius Hildanus relates miracles.

But if these accounts were true, callus must be inorganic; or else one would be compelled to admit, that the inspissation of an inorganic fluid was capable of producing an organized substance: which is an absurdity. Besides, observation demonstrates, that callus is an organized matter, like the substance of the bone itself, which it resembles, and that, when subjected to anatomical and chymical experiments, it exhibits all the appearances of the proper substance of bones.

According to Duhamel, callus is formed by the periosteum, which he regards as the organ of ossification. When a bone is fractured, (says this naturalist) the periosteum of the two fragments first grows together, and then swells, and forms a circular rising round the fracture. The thickened membrane is converted into a gelatinous substance, which soon becomes a cartilaginous matter. In this, vessels develop themselves, and different points of ossification commence, which multiply and unite. Thus, when every part of the periosteum near the fracture is hardened and ossified, this membrane is changed, as it were, into a sort of clasp, which extends over the two fragments, and holds them together.

It was objected to Duhamel's theory, that if a bone be slit longitudinally in the situation of a former fracture, the fragments are observed to have their substances blended completely together, and not simply to lie in contact in the manner of two pieces of

wood placed end to end, and kept in contact by means of a clasp. Duhamel, with a view of obviating this difficulty, supposes that the periosteum elongated itself from the circumference towards the centre of the bone, and that such continuation of this membrane underwent the same changes, as that portion which was contiguous to the fracture, and thus served to unite the ends of the fragments, between which it was interposed. He admits, also, in some cases, that the internal periosteum, or medullary membrane, may furnish productions extending between the ends of the fracture, like the continuation of the external periosteum, with which they become connected. Lastly, he supposed, that, in young subjects, whose bones had not acquired their full degree of hardness, the cartilaginous part was capable of extension, and that in cases of fracture, it contributed to the more perfect union of the fragments.

The system of Duhamel was opposed by Haller and Dethleef, who, after a long series of well-performed experiments, came to the conclusion, that the callus was formed by a gelatinous juice, which exudes from the extremity of the fractured bone, particularly from the medullary texture, and is effused all about the fracture; that such juice is organized, forms a cartilage, and at length ossifies.

But, as Boyer justly remarks, whatever difference there may seem to be betwixt this doctrine, and that of Duhamel, it is merely in the mode of explaining the facts. All these observers noticed the same phenomena; and all the experiments of Dethleef accorded perfectly well with those of Duhamel. Both found, during the first days, immediately after the fracture, a lymph extravasated between the fragments, and a small tumour in the situation of the fracture. Both also remarked, that this tumour became softer, and that it afterward formed a gelatinous, then a cartilaginous, and lastly a bony, substance, which composed the uniting medium. But, Duhamel contends, that the cartilage is produced by the periosteum, while Haller and Dethleef argue, that it is the production of the extravasated lymph.

Professor Boyer thinks, that Duhamel imputes too much to the periosteum; but, that Haller and Dethleef were also wrong, if they supposed, as Fougéroux alleges, that an unorganized lymph could produce an organized substance by inspissation. (See *Le Second Mémoire sur les Os, par M. Bordenave, recueilli et publié par M. Fougéroux, p. 124.*)

It appears to Boyer much more natural to believe, that the gelatinous lymph already contains the rudiments of organization, which become visible as they are developed; just as it is usually believed, that the rudiments of all our organs are contained in the transparent mucilage, of which the embryo seems to consist.

The experiments of Duhamel and Dethleef were carefully repeated by Bordenave, who ascertained several new and interesting

facts. The result was the same in regard to the phenomena observed; but the explanation of them was different.

Instead of attributing the formation of callus to the periosteum, like Duhamel; or to the extravasation of lymph, like Dethleef; Bordenave conceived, that broken bones unite again by a process analogous to that, which nature employs for the union of the divided soft parts. His inference is principally founded on two facts generally admitted; 1st, that there is in the bones a vascular texture, designed to maintain the circulation in them; 2dly, that such texture dilates when fractures are uniting, as appears from the swelling in the situation of the fracture, without which swelling, there could be no union. Bordenave further remarks, with Haller and Dethleef; 1st, That callus, at the commencement of its formation, appears to consist of a glutinous fluid effused from the ruptured vessels. 2dly, That this substance afterward assumes the form of cartilage, to which certain vessels are distributed, which deposit the bony matter, and thus begin the generation of callus. 3dly, That the particles of bone, being all joined together, the callus changes into a porous substance, which in time becomes solid and compact, like the substance of bones.

Doubtless (says Boyer) we shall always remain ignorant of the process, which nature employs for the union of the bones, as well as for that of the soft parts. Every theory, which can be invented on this point, will only be conjectures more or less probable. However, if this author were to adopt any system exclusively, he expresses that he should prefer that of Bordenave.

The mechanism of nature, in the formation of callus, must be analogous to that which she adopts in the union of wounds. The principal difference seems to be, that in the union of a fracture, the vessels after a time deposit the phosphate of lime. The vessels of the periosteum, medullary membrane, and probably also those of the soft parts in the immediate vicinity of the fracture, first effuse coagulating lymph. This gradually becomes vascular, and in proportion as the vessels acquire the power of secreting earthy matter, it is by degrees converted into new bone, termed *callus*, which from being at first soft and flexible, at length becomes firm and unyielding, and fit for constituting the future bond of union between the two extremities of the fracture.

The observations made by Baron Larrey, lead him to reject as entirely erroneous, the doctrine, which refers the production of callus to the periosteum, and he adopts the opinion, that the union and reparation of bones are the work of their own vessels. He adverts to examples, in which after the use of the trephine in young subjects, the perforation becomes more or less closed by new bone, thrown out from the circumference towards the centre. Here, says he, the ossification assuredly can neither be referred to the pericranium, nor the dura-ma-

ter. The first of these membranes has been extensively destroyed, and, if the second were concerned, a vertical substance, shutting up the opening, would be apparent. In further support of his opinions, Baron Larrey cites the well-known celerity, with which fractures of the lower jaw unite, on account of the great vascularity of that bone, and he believes, with Mr. A. Cooper, that if the ends of a fracture do not touch in consequence of loss of substance, the intervening space remains unfilled up by new bone; a position, which seems rather repugnant to what has been said concerning the mode of reparation after the use of the trephine.

Larrey has often seen the superficial layers of the tibia exfoliate, after a necrosis produced by a cause, which had destroyed the whole of the periosteum on the front surface of that bone, as is sometimes the case in hospital gangrene. He has seen these layers replaced by red vascular granulations, disposed in parallel lines, which granulations soon ossified, that is to say, phosphate of lime was substituted for the vermilion colour of the vessels, and gave the new-formed substance the appearance and consistence of bone. Lastly, this substance was covered with a new cellular membrane, derived from the adjacent textures; but, in the place of the cicatrix, a depression always remained, proportioned to the loss of substance. If the formation of callus depended on the periosteum, Larrey argues that the broken patella could never unite by bone, as it is often found to do, when the fragments are kept closely in contact. Here he contends, that the union is the result of the work and inoculation of the vessels belonging to the substance of the fragments themselves. Lastly, he adverts to preparations, in which the vessels of callus have been actually injected by the celebrated Soemmering. (See *Journ. Complém. du Dict. des Sciences Méd.* T. 8, p. 107, &c. 8vo. Paris, 1820.)

From experiments, instituted by Breschet and Villerme, it would appear, that the union of broken bones is not exclusively owing to the effusion of a particular fluid, which concretes and gradually changes into an osseous substance; nor to the ossification of the swollen and elongated periosteum; nor, in the majority of instances, to granulations produced from the surfaces of the fracture; but, it is frequently dependent upon all these circumstances together, or at least several of them; and, in every case, it is the result of a series of changes, observable in the soft parts immediately adjoining the fracture, in the periosteum, in the medullary structure, in the cavities and very texture of the bones themselves, and in the substance intervening between the two fragments. In simple fractures, the following are stated to be the principal circumstances remarked during the process.

1. Extravasation and coagulation of a small quantity of blood between the ends of the fracture, which blood escapes from torn, or ruptured vessels.

2. A fluid, at first of a viscid quality, effused and secreted, as it were, between the periosteum and the bone, and likewise exuding from the surfaces of the fracture, and the soft parts.

3. A gradual increase in the quantity and consistence of the preceding substances blended together, forming every day a stronger and stronger connexion between the parts; then their change to a red intermediate substance between the fragments, and between the bone and the periosteum, to a substance which is at first soft, but in the end acquires the characters of bone.

4. At the fractured part, a reunion of the periosteum, and soft parts, which are equally indurated and confused together, with the intermediate substance between the fragments.

5. A diminution, and then an obliteration, of the medullary cavity, at first by a cartilaginous, and then a bony deposition.

6. Successive ossification of the whole of the swelling, composing the callus, and of the substance between the fragments, preceded by a fibrous and cartilaginous state.

7. The return of the soft parts around the fracture, and then of the periosteum, to their natural state.

8. After the union of the surfaces of the fracture, the medullary cavity and texture are gradually re-established, and the swelling, formed by the callus, always diminishes.

But, in compound fractures, besides these circumstances, the production of granulations from the surfaces of the bone is also to be taken into the account. (See *Dict. des Sciences Med.* T. 38, P. 436.) This difference from what happens in the process of union of simple fractures is also particularly noticed by Mr. Wilson: "from the parts being exposed (in a compound fracture,) the first bond of union, viz. the coagulable lymph of the blood is removed, or destroyed before it can become vascular. Inflammation in consequence of the injury comes on, suppuration takes place, and, when the parts are healthy, granulations arise. These granulations from the broken extremities of the bone soon assume the ossifying disposition, and when they come in contact with each other unite." (*On the Skeleton, Diseases of the Bones, &c.* P. 233, 8vo. Lond. 1820.) It is a curious fact, that broken cartilages are united by means of bone; a circumstance, which has often been noticed in respect to the cartilages of the ribs.

Whatever may be the process, by which callus is formed, it is during the first two or three weeks after the fracture, that the fragments undergo the changes, which promote their reunion. But, it is between the twentieth and thirtieth, and especially between the thirtieth and fiftieth days, that nature labours effectually in consolidating the callus. Hence, at this period, our care to retain the ends of the fracture in exact contact and perfectly at rest should be redoubled; for though there are a few instances, in which deformity really proceeds from irregular os-

sifications, it is almost always a fact, that the deformity originates from the fracture being disturbed and not kept properly reduced. (*Boyer, Traité des Mal. Chir.* T. 3, p. 86, &c.)

4. Of the Conduct to be adopted at the ordinary Period of the Consolidation of Fractures; and of the Treatment of False Joints.

When the requisite time for a broken bone to become firmly united has elapsed, it is proper to examine carefully and cautiously the place of the fracture, in order to learn whether the callus has acquired a suitable degree of strength. If the bone should be found to bend in the least at the injured part, the callus is not sufficiently strong, and the limb should be immediately put up in the apparatus again, with a view of preventing a new fracture, or, at all events, deformity.

For the same reason, the patient should not be allowed to make use of his limb, immediately the fracture has united. In fractures of the lower extremity, he ought to use crutches, and only let the weight of the trunk by degrees bear upon the injured limb. From neglect of this precaution, the callus has been known to be absorbed, the limb to be shortened, and the patient become a cripple. An accidental slip may also produce the fracture again; for, notwithstanding the assertion of writers, the callus, so far from being firmer than the rest of the bone, is not so strong till after a certain time. (*Boyer, T. 3, p. 93.*)

If, when the necessary time for the completion of the union has expired, the callus is not yet firm, we must examine; 1st, The relative position of the fragments, and the consistence of the callus. 2dly, The causes, which may have retarded its consolidation.

That the state of the constitution has considerable influence over the process by which broken bones are reunited, is unquestionable. Schmecker found the formation of callus, even in the most simple fractures, sometimes delayed eight months, and in one example more than a year; but the patients were all of them unhealthy subjects. (*Ver-mischte Chir. Schriften*, 1 B. p. 26.)

There are certain indescribable constitutions, in which bones, more particularly, however, the os brachii, will not unite again after being broken. These temperaments are also very various; at least I infer so from two subjects, to whom I paid particular attention. One was a strong, robust man, whose chief peculiarity seemed to be his indifference to pain: the ends of his broken humerus were cut down to, turned out, and sawn off, by Mr. Long, in St. Bartholomew's hospital, and the limb was afterward put in splints, and taken the greatest care of; but no union followed. The other case was a broken tibia and fibula, which remained disunited for about four months; but afterward grew together. The latter subject was a complete instance of hypochondriasis. I have since seen a woman, under Sir James Earle, in the above hospital, whose os brachii did not unite in the least, though it had been broken

several months. Every attempt to move the bone occasioned excruciating torture. The woman died of some illness in the hospital, and on dissecting the arm, the cause of the fracture not having united was found to arise from the upper, sharp, pointed extremity of the lower portion of the broken bone having been forcibly drawn up by the muscles, and penetrated the substance of the biceps, in which it still remained. I am indebted to Mr. Henry Earle for the account of the appearance on dissection, and I do not know that this kind of impediment to the union of a fracture has been noticed by any earlier writer than Mr. Charles White, who appears to have conceived the possibility of the occurrence. (*Cases in Surgery*, p. 70, *Edit.* 1770.)

The causes of fractures remaining disunited will, according to Richerand, be found to depend, either upon the broken ends of the bone not being properly in contact; the limb having been moved too much; the advanced age of the patient; or upon a general inertia and languor of the constitution. (*Nosographie Chir.* Tom. 3, p. 37, *Edit.* 2.)

It is observed by Larrey, that the gunshot wounds of the extremities, complicated with fracture, especially with that of the humerus, received by the soldiers of the French army in Syria, were almost all followed by the formation of accidental joints. The two fragments of the broken bone continued moveable, their asperities and projecting angles having been destroyed by friction, and their ends being rounded and covered with a cartilaginous substance, so as to facilitate the motions, which the patients executed in various directions, in an imperfect manner, and without pain. Larrey acquaints us, that many invalids were sent back to France with such infirmity.

"I ascribe," he says, "the causes of these accidental articulations:

"1. To the continual motion to which the wounded soldiers were exposed after their departure from Syria, till their arrival in Egypt, in consequence of their having been obliged either to walk this journey on foot, or to be carried it on beasts.

"2. To the bad quality of the food, and the brackish water, which the men were under the necessity of drinking in this painful journey.

"3. To the state of the atmosphere of Syria, almost entirely destitute of vital air, and impregnated with pernicious gases, issuing from the numerous marshes near which we were a long while stationed.

"All these causes may have prevented the formation of callus, either by diminishing the quantity of the phosphate of lime, or moving the bones out of that state of coaptation in which they should constantly lie in order to unite.

"Bandages, embrocations, rest, and regimen, proved quite ineffectual."—(*Larrey Mém. de Chir. Mil.* T. 2, p. 131, 132. *Langenbeck. N. Bibl. B. 1.* p. 81.)

The presence of an ulcer, a sinus, loose splinters of bone, a necrosis, or other suppu-

rating disease, near a fracture, is a circumstance that often appears seriously to retard, or completely to prevent the formation of callus. How frequently have I noticed, in cases of compound fracture, that, while the wound suppurates largely, and while there are spiculae and dead portions of bone unextracted, no solid union takes place; but that as soon as the wound, ulcer, or sinus admits of being healed, and the suppuration ceases, the callus begins to form in the most favourable manner. Schmucker relates a case, illustrating the truth of these observations, where the tibia and fibula were broken so obliquely, that the ends of the fracture could not be made to lie well, a necrosis of a portion of the tibia followed, and no callus was formed at the end of eight months, when a sinus on each side of the leg still continued. This eminent surgeon now laid the sinuses open, and extracted the dead pieces of bone, by which means the impediment to the formation of callus was removed, and the fracture, which had till then remained loose and moveable, became firmly united in two months. (*Vermischte, Chir. Schrift.* 1 B. p. 25, 26.)

False or preternatural articulations, which occur in cases of fracture without union, have been generally supposed to resemble common joints. According to Boyer, this opinion is incorrect. The ends of the fracture, which are sometimes rounded, and sometimes pointed, are connected together by a cellular and ligamentous substance. But their surfaces are not covered by a smooth cartilaginous matter, nor is there constantly a capsular ligament. "I am convinced of this fact, by the dissection of several ununited fractures, the fragments of which are preserved in my museum." (*Boyer, T. 3, p. 94.*) And in another place, the same Professor, speaking of these false joints, remarks: "I repeat that I have never found, in their structure, any thing which could be compared with an articulation; neither capsular ligament, nor smooth cartilaginous surfaces. On the contrary, I have invariably found in the false joints of the thigh-bone and humerus, which I have had opportunities of dissecting, a fibrous ligamentous substance extending from one fragment to the other, and it is very probable, that, with some modifications, it is the same with all the other cases which I have not seen.

"But in the fore-arm, the ends of the fracture may assume a structure which bears a greater resemblance to an articulation. This is what happened in an example, which was communicated to Bayle by Sylvestre, in the *Republique des Lettres*, Juillet 1685, p. 718, &c. A similar case is recorded by Fabricius Hildanus, Obs. 91. *Centur. 3.*" (*Boyer, Traité des Mal. Chir.* T. 3, p. 101—103.)

On this subject, Langenbeck observes, that the edges of the fragments heal, and resemble those of a harelip. "When the parts are incessantly moved, the end of one fragment becomes excavated in the form of an articular cavity. I have in my possession (says he) a lower jaw, and an olecranon, the frac-

tures of which are not united. For the connecting medium, nature has provided a white substance, resembling ligament. In a male patient, I have also seen an articular connexion established in the body of the thigh-bone, subsequently to a fracture." (*Neue Bibl. B. 1, p. 93*) When a capsule is formed, it is alleged not to be of a ligamentous nature. (*Bichat, Anatomie Générale, T. 3, p. 191.*)

In the Hunterian Collection may be seen a false joint in the bones of the fore-arm, where the resemblance to a natural articulation was greater than what Boyer has seen in other situations.

A valuable dissertation on false joints has been published by Reisseisen, entitled "*De Articulationibus analogis, quæ fracturis ossium superveniunt*;" but I am sorry that it has not been in my power to meet with a copy of it.

A false joint in the arm, or fore-arm, does not absolutely prevent the motion of the limb, which may yet be of considerable use; but when the disease is in the thigh, or leg, the member cannot support the weight of the body, and the patient is unable to walk without crutches.

The diversity of causes which may be concerned in preventing the union of fractures, plainly shows, that the treatment should be different in different cases.

When the want of union is ascribable to the ends of the fracture not being in a state of coaptation, and to their having been moved about too frequently, the obvious indications are, to set the fracture better, and to take adequate measures for keeping its extremities in contact and perfectly motionless.

If the union has been prevented by a portion of muscle or other soft part, getting between the ends of the bone, the only means of affording a chance of union, would be cutting through the integuments, removing the displaced soft parts, and placing the ends of the bone in contact. (*Wardrop in Med. Chir. Trans. Vol. 5, p. 360.*)

When the advanced age of the patient seems to be the cause of the union not taking place, the application of the proper apparatus is to be continued a considerable time, since experience proves, that in old subjects the cure of fractures often requires many months. In such examples, also, tonic and cordial medicines, with a nutritive diet, are highly proper.

When several months have elapsed since the accident, and there is reason to apprehend that a preternatural joint is formed, a variety of plans have been proposed and practised.

The most ancient method of treatment is that of forcibly rubbing the ends of the fracture against each other, so as to make them inflame, and take on a disposition to form callus. This plan was recommended by the late Mr. John Hunter, and has had the approbation of many other distinguished modern practitioners. Mr. Hunter used even to advise us, in the case of a disunited frac-

ture of the leg, or thigh, to let the patient get up, and attempt to walk with the splints on the limb, so that the requisite irritation might be produced. The idea of exciting a degree of inflammation in the situation of the fracture, certainly appears rational, and I believe the practice has been attended with a limited degree of success. Mr. White records an example, in which he cured a broken thigh on this principle, a strong leather case having been made for the limb. (*Cases in Surgery, p. 75.*) The method is spoken of in Celsus: *si vetustas occupavit, membrum extendendum est ut aliquid ledatur: ossa inter se manu dimovenda, ut concurrendo exasperentur. et ut si quid pingue est, eradatur, totumque id quasi recens fiat; &c.*

The foregoing treatment, however, is only likely to answer before a new joint, or at all events a ligamentous fibrous connexion, is completely formed, and when the limb has hitherto been kept entirely motionless.

When the case is old, and there is every cause for believing that a preternatural articulation, or fibrous ligamentous connexion has taken place, we are advised to cut down to the ends of the bone, rasp or saw them off, and then treat the limb just as if the case were a recent compound fracture.

This bold practice was first suggested by Mr. C. White: "Robert Elliot, of Eyham, in Derbyshire, a very healthful boy, nine years old, had the misfortune about midsummer, in the year 1759, by a fall, to fracture the humerus, near the middle of the bone. He was immediately taken to a bone-setter in that neighbourhood, who applied a bandage and splints to his arm, and treated him as properly," says Mr. White, "as I suppose he was capable of for two or three months. His endeavours, however, were by no means productive of the desired effect, the bones not being at all united. A surgeon of eminence, in Bakewell, was afterward called in; but as he soon found he could be of no service to him, and as the case was very curious, he advised the lad's friends to send him to the Infirmary at Manchester. He was accordingly brought thither the Christmas following, and admitted an in-patient. Upon an examination, we found it to be a simple oblique fracture, and that the ends of the bone rode over each other: his arm was become not only entirely useless, but even a burthen to him, and not likely to be otherwise, as there was little probability that it could ever unite, it being now six months since the accident happened.

"Amputation was therefore proposed as the only method of relief: but I could not give my consent to it, for as the boy was young, and had a good constitution, it was hardly possible that it could be owing to any fault in the solids or fluids, but that either nature was disappointed in her work by frequent friction, while the callus was forming, or rather, that the oblique ends of the bone, being sharp, had divided a part of a muscle, and some portion of it had probably insinuated itself betwixt the two ends of the bone, preventing their union. Whichever of these

might be the case, I was of opinion," continues Mr. White, "that he might be relieved by the following operation, viz. by making a longitudinal incision down to the bone, by bringing out one of the ends of it, which might be done with great ease as the arm was flexible, and cutting it off, either by the saw or cutting-pincers, then by bringing out the other, and cutting off that likewise, and afterward by replacing them end to end, and treating the whole as a compound fracture.

"The objections made by the other gentlemen concerned, to this proposal, were, first, the danger of wounding the humeral artery by the knife. Secondly, the laceration of the artery by bringing out the ends of the bones. And, thirdly, that we had no authority for such an operation. As to the first, that was easily obviated, by making the incision on the side of the arm, opposite to the humeral artery. The place of election appeared to me to be at the external and lower edge of the deltoid muscle, as the fracture was very near to the insertion of that muscle into the humerus; the danger of wounding the vessel not only being by that means avoided, but after the operation, while the patient was confined to his bed, the matter would be prevented from lodging, and the wound be easily come at, to renew the dressings. The second objection will not appear to be very great, when we consider that in compound fractures the bone is frequently thrust with great violence through the integuments, and seldom attended with laceration of any considerable artery; and as this would be done with great caution, that danger would appear very trifling. The third and last objection is no more than a general one to all improvements.

"This method which I have been proposing," says Mr. White, "was at last resolved upon, and I assisted in the operation, which was performed by a gentleman of great abilities in his profession, on January 3, in the present year (1760.) The patient did not lose above a spoonful of blood in the operation, though the tourniquet was not made use of. When the operation and dressings were finished, the limb was placed in a fracture box, contrived on purpose, the lad confined to his bed, and the rest of the treatment was nothing different from that of a compound fracture.

"The wound was nearly healed in a fortnight's time, when an erysipelas came on, and spread itself all over the arm, attended with some degree of swelling; this by fomentations, and the antiphlogistic method, soon went off, and the cure proceeded happily, without any other interruption. In about six weeks after the operation the callus began to form, and is now quite firm. The arm is as long as the other, but somewhat smaller, in consequence of such long continued bandages; he daily acquires strength in it, and will soon be fit to be discharged." (*Cases in Surgery*, p. 69, &c.)

In another instance of a broken tibia,

which continued disunited an extraordinary length of time, Mr. White practised an operation, somewhat similar to the foregoing one, with complete success. He made a longitudinal incision, about four inches in length through the integuments, which covered the fracture. By the application of a trephine, he cut off the upper end of the bone, and as the lower end could not be easily sawn off, he contented himself with scraping it. In the course of the subsequent treatment, he had occasion to take off, with the cutting-pincers, a small angle of tibia, and to touch the lower part of the bone with the butter of antimony, as well as to introduce the same caustic between the extremities of the fracture, in order to destroy a substance which intervened. A trifling exfoliation followed. In twelve weeks the bone was firmly united. (*Op. cit.* p. 81, 82.)

Besides Mr. White's cases, there are now some other instances upon record, where the operation which he first proposed, has succeeded. In the year 1813, Langenbeck operated upon a humerus in the foregoing manner, and the result was perfectly successful. The ununited fracture was situated at the insertion of the deltoid. (*Neue Bibl. B. 1*, p. 95.) Mr. Rowlands, of Chester, by a similar operation, cured a fractured thigh, which had lost all disposition to unite (See *Med. Chir. Trans. Vol. 2*, p. 47.) Viguerie, surgeon to the Hôtel Dieu, at Toulouse, has also practised Mr. White's operation with success. (See *Larrey, Mém. de Chir. Militaire*, T. 2, p. 132.)

On the other hand, the operation has frequently failed. In the instance in which I saw it executed on the humerus by Mr. Long, in St. Bartholomew's Hospital, it did not answer, though the ends of the bone were most fairly sawn off, and the case treated with particular care and skill. Boyer states that he once performed the same operation in a similar case; but that it had not the desired effect; (*Traité des Mal. Chir.* T. 3, p. 110.) Dr. Physic, of New-York, when he was a student in 1785, saw this proceeding unsuccessfully adopted in a case, where the humerus remained disunited. (See *Medical Repository*, Vol 1, New-York, 1804.) Besides these examples, I have heard of others, in which Mr. Cline and other practitioners have tried the experiment with no better success. What is still more discouraging, the operation has sometimes proved fatal. (*Richerand, Nosogr. Chir.* T. 3, p. 39. Edit. 2. *Larrey, Mém. de Chirurgie Militaire*, T. 2, p. 132.)

The difficulties, the danger, and the frequent ill success of the foregoing operation, rendered another mode of treatment extremely desirable, when Dr. Physic, of New-York, suggested the plan of introducing a seton through the preternatural joint, with a view of exciting inflammation, and bringing about an union of the bone. This suggestion promises to be a considerable improvement in modern surgery. Dr. Physic had an opportunity of performing the new

operation on the 18th December, 1802, in an example of disunited humerus, twenty months after the occurrence of the accident. "Before passing the needle (says Dr. Physic) I desired the assistants to make some extension of the arm, in order that the seton might be introduced, as much as possible, between the ends of the bone. Some lint and a pledget were applied to the orifices made by the seton needle, and secured by a roller. The patient suffered very little pain from the operation. After a few days, the inflammation, (which was not greater than what is commonly excited by a similar operation through the flesh of any other part) was succeeded by a moderate suppuration. The arm was now again extended, and splints applied. The dressings were renewed daily for twelve weeks, during which time no amendment was perceived; but, soon afterward, the bending of the arm at the fracture was observed not to be so easy as it had been, and the patient complained of much more pain, than usual, whenever an attempt was made to bend it at that place. From this time, the formation of the new bony union went on rapidly, and on the 4th of May, 1803, was so perfectly completed, that the patient could move his arm in all directions, as well as before the accident happened. The seton was now removed, and the small sores occasioned by it healed up entirely in a few days. On the 28th of May, 1803, he was discharged from the hospital perfectly well, and he has since repeatedly told me, his arm is as strong as ever it was." (*Physic, in Medical Repository, Vol. 1. New-York.*)

On this subject an interesting memoir was read by Laroche to the Ecole de Médecine at Paris (Germinal, an 13.) It was entitled, "*Dissertation sur la non ré-union de quelques fractures, et en particulier de celles du bras, et sur un moyen nouveau de guérir les fausses articulations qui en résultent.*" The author of this production affirms that, when he was at Augsburg, he saw Baron Percy, then with the army of the Rhine, pass a seton through the imperfectly healed cicatrix of a compound fracture of the thigh, which fracture seemed to have lost all disposition to unite. The method answered so well, that in two months the patient was able to walk without crutches. The French assert, that this operation was done when no knowledge of Dr. Physic's case had reached France.

Mr. Brodie has also successfully employed the seton in a case of ununited broken thigh. The patient was a boy, about 13. (See *Med. Chir. Trans. Vol. 5, p. 387, &c.*) In this country, the same operation has been practised for the cure of a disunited humerus by Mr. Stansfield, of Leeds. (See *Op. cit. Vol. 7, p. 103, &c.*) It appears, also, that Mr. Charles Bell applied the method to a fracture of the leg, at the time when Roux was in England. The patient was a child six years old, and the broken bone had continued without union three years. The case had been originally mistaken by some un-

skilful surgeon for a mere contusion. Roux knew not whether the operation succeeded or not. (*Parallèle de la Chir. Angloise, &c. p. 195.*)

We are not to expect, however, that Dr. Physic's new operation will succeed in every instance. Like most other surgical means, it is liable to occasional failures, among which, I believe, we must include the attempt made on a disunited thigh by Mr. Wardrop, (See *Med. Chir. Trans. Vol. 5, p. 365.*) though a partial amendment is mentioned. Mr. Hutchinson was also obliged to take out the seton, in a case of ununited humerus, and no cure was effected. (See *Practical Obs. p. 162.*) Another instance of failure has likewise been mentioned to me.

FRACTURES OF THE OSSA NASI.

These bones, from their situation, are much exposed to fractures. The fragments are sometimes not deranged; but most frequently, they are depressed. In order to replace them, the surgeon must pass a female catheter, a ring-handled forceps, or any such instrument, into the nostrils, and using it as a lever, push the fragments outwards: while with the index finger of the left hand, he prevents them from being pushed out too far. When the fragments are disposed to fall inwards again, some authors advise supporting them with an elastic gum cannula, or lint, introduced into the nostril; but I am inclined to believe with Mr. C. Bell, that no tubes can be employed so as to support the broken bones; and when these have been replaced, they will not readily change their position, as they are acted upon by no muscles. (See *Operative Surgery, T. 2, p. 222*.)

Besides, as Delpsch remarks, since the tubes cannot reach the fragments, they cannot support them, and they must be attended with all the inconvenience of foreign bodies placed in contact with parts already inflamed, or about to become so. (*Précis des Mal. Chir. T. 1, p. 222.*)

As fractures of the ossa nasi are the result of falls, and direct blows on the face, the soft parts are always either very much contused or wounded.

Fractures of the ossa nasi are sometimes attended with very dangerous symptoms; depending either upon the concussion of the brain, produced by the same blow, which caused the fracture; or on the cribriform lamella and the crista galli of the os ethmoides being driven inwards so as to injure and compress the brain. This last danger, however, some modern surgeons consider as void of foundation, and whenever the symptoms indicate an affection of the brain, the nature of the case is referred to the intimate connexion between the bones of the nose and the os frons. (*Delpsch, Précis des Mal. Chir. T. 1, p. 221, Bro. Paris, 1816.*)

When there are symptoms of pressure on this organ, (see *Head, Injuries of*.) and the ossa nasi are much depressed, the surgeon must immediately raise them, and endeavour

to draw gently forwards the perpendicular process of the os ethmoides, which is connected with the cribriform lamella and crista galli. Perhaps, a pair of closed common forceps introduced into each nostril, might best enable the surgeon to do what is necessary. Bleeding and the antiphlogistic treatment are always proper; for, the vicinity of the eye renders it liable to become inflamed; and when there are symptoms of injury of the brain, extravasation, &c. the necessity of such practice is still more strongly indicated.

FRACTURES OF THE LOWER JAW.

This bone is sometimes fractured near the chin; but seldom so as to produce a division of the symphysis, the solution of continuity generally happening between this part and the insertion of the masseter. In other instances, the fracture occurs near the angles of the jaw, that is to say, between the insertion of the masseter and the root of the coronoid process. The bone may also be broken in two places at the same time; - in which event the middle portion is extremely difficult to keep right, because many of the muscles, which draw the lower jaw downwards, are attached to that part.

The condyles and coronoid processes are also sometimes broken; the former the most frequently.

Fractures of the lower jaw may be either perpendicular to its basis, oblique, or longitudinal: of the latter, examples have been known in which a portion of the alveolar process with the teeth in it was detached from the rest of the bone.

The soft parts are generally contused and wounded. J. L. Petit mentions one case, in which the bone was broken, and the coronoid process quite denuded, by the kick of a horse.

Fractures of the lower jaw are subject to displacement in the following way. When the fracture is near the symphysis, the side on which the processus innominatus is situated is drawn downward and backward by the sub-maxillary muscles, while the other fragment is supported by the muscles which close the jaw. When the fracture is more backward, the displacement occurs in the same way, but not so easily. When the bone is fractured in two places, the middle portion is always pulled downwards and backwards by the muscles attached to the chin, while the two lateral pieces are kept up by the levator muscles. When the ramus of the jaw is broken, the masseter, being attached to both pieces, prevents any considerable degree of displacement. When the neck of the condyle is fractured, the pterygoideus externus may pull the condyle forwards.

When a blow is received on the lower jaw, or the bone is injured by a fall, or by the pressure of some heavy body; when an acute pain is experienced in the part, and an inequality can be felt at the basis of the bone; when some of the teeth, correspond-

ing to that inequality, are lower than the others; and when a crepitus is perceptible on moving the two pieces of the jaw on each other; there can be no doubt of a fracture. When the gums are lacerated, or the bone denuded by a wound, the case is (if possible) still more manifest.

Fractures of the rami and condyles produce great pain near the ear, particularly when the jaw is moved; and a crepitus may also be felt.

Fractures of the lower jaw, whether simple or double, are easily set, by pushing the displaced part upward, and a little forward, and then pressing on the basis of the bone, so as to bring it exactly on a level with the portion which has preserved its natural position. Indeed, the correctness of the reduction can always be rightly judged of by attending to the line which the base of the jaw ought to form, and observing that the arch of the teeth is as regular as nature will allow. The maintenance of the reduction, however, is difficult; and can only be well executed by supporting the lower jaw, and keeping it applied to the upper one. As the latter indication cannot be properly fulfilled in persons whose teeth are very irregular, it is sometimes necessary to interpose an even piece of cork between the teeth on each side of the mouth, and against this cork the lower jaw is to be kept up with the bandage presently noticed, while the aperture left between the incisores in the situation where no cork is placed, allows food and medicines to be introduced with a small spoon.

As soon as the fracture is set, the surgeon should adapt some thick pasteboard, previously wet and softened with vinegar, to the outside of the jaw, both along its side and under its basis. Over this moistened pasteboard a bandage with four tails is to be applied, the centre being placed on the patient's chin, while the two posterior tails are to be pinned to the front part of a nightcap, and the two anterior ones fastened to a part of the same cap more backward. When the pasteboard becomes dry, it forms the most convenient apparatus imaginable for surrounding and supporting the fracture. A piece of soap-plaster may now be applied to the skin underneath, which will prevent any ill effects of the hardness and pressure of the pasteboard.

Until the bone is firmly united, the patient should be allowed only such food as does not require mastication, and it may be given by means of a small spoon introduced between the teeth. Broths, soups, jellies, tea, and other slops, appear most eligible.

In order to keep the middle portion of the bone from being drawn downwards and backwards towards the larynx, it is frequently necessary to apply tolerably thick compresses just under and behind the chin; which are to be well supported by the bandage already described.

I need hardly state the necessity of enjoining the patient to avoid talking, or moving the jaw more than can possibly be avoided.

When the condyle is fractured, as it is in-

cessantly drawn forward by the action of the pterygoideus externus, and, on account of its deep situation, cannot be pressed back, the lower portion must, if possible, be pushed into contact with it. For this purpose, the bandage must be made to operate particularly on the angle of the jaw, where a thick compress should be placed.

Compound fractures of the lower jaw are to be treated on the same principles as similar injuries of other bones. If possible, the external wound should be healed by the first intention; and, when this attempt fails, care must be taken to keep the wound clean by changing the dressings about once in three days; but not oftener, lest the fracture suffer too much disturbance. It is observed, that compound fractures of the jaw, and even simple ones, which are followed by abscesses, are particularly liable to be succeeded by troublesome and tedious exfoliations.

In very bad fractures, in which all motion of the jaw must have the most pernicious effect, I consider it prudent to administer every kind of nourishment in a fluid form, through an elastic gum catheter, introduced through one of the nostrils down the œsophagus.

FRACTURES OF THE VERTEBRÆ.

On account of the shortness and thickness of these bones, they cannot be broken without considerable violence. The spinous processes, which project backwards, are the most exposed to such injury; for they are the weakest parts of the vertebræ, and most superficially situated. The violence, which is great enough to break the bodies of the vertebræ, must produce a greater or less concussion, or other mischief, of the spinal marrow; from which accident much more perilous consequences are to be apprehended than from the injury of the bones, abstractedly considered. The displaced pieces of bone may press on the spinal marrow, or even wound it, so as to occasion a paralytic affection of all the parts, which derive their nerves from the continuation of this substance below the fracture.

As the mere concussion of the spine may occasion symptoms which very much resemble those usually occurring, when the vertebræ are fractured, the diagnosis is generally obscure. Perhaps an inequality in the line of the spinous processes may be observed. The lower extremities, the rectum, and bladder, are generally paralytic; the patient is afflicted with retention of the urine and feces, or with an involuntary discharge of the latter. (*Boyer*.)

Fractures of the spinous processes, without other serious mischief, are not dangerous; and are the only instances of fractures of the vertebræ which admit of being detected with certainty.

Any attempt to set fractures of the bodies of the vertebræ, even were they known to exist, would be both useless and dangerous. General treatment can alone be employed. Cupping will tend to prevent inflammation in the situation of the injury. When the pa-

tient is affected with a flatulent distention of the abdomen, vomiting, hiccough, &c. the belly may be rubbed with camphorated liniment, and purgative clysters and antispasmodics given.

If requisite, the urine must be drawn off with a catheter. When the bladder, rectum, and lower extremities are paralytic, it is common to rub the back, loins, sacrum, and limbs, with liniments containing the tinctura lyttæ. (*Boyer*.) With respect to the external and internal use of stimulants, however, it can never be judicious, when there is reason to apprehend much inflammation of the injured parts; and as for the idea of thus restoring the nervous influence, there can be little chance of success, the cause of its interruption being here of a mechanical nature. (*Delpech, Mal. Chir. T. 1. p. 222.*)

Some authors recommend trepanning, or cutting out a portion of the fractured bone, when the compression of the spinal marrow, or its injury by a splinter, is suspected; but, exclusively of the difficulty of that operation, on account of the great depth of the intervening soft parts, the indication is never sufficiently evident to authorize it. (*Boyer*.)

Some cases published by Mr. C. Bell tend to prove, that the danger to be apprehended from injuries of the vertebræ, is the same as that which accompanies injuries of the brain. Hence he joins the generality of practitioners in recommending general and local bleeding, and keeping the patient perfectly quiet. And, with respect to operations for the removal of fragments of bone, it is his decided belief, that an incision through the skin and muscles covering the spine, and the withdrawing of a portion of the circle of bone which surrounds the marrow, would be inevitably fatal, the membranes of that part being particularly susceptible of inflammation and suppuration. And, even if a sharp spicula of fractured bone had run into the spinal marrow, and caused palsy of the lower parts of the body, Mr. C. Bell thinks that exposing the medulla to extract the fragment would so aggravate the mischief, that inflammation, suppuration, and death, would be the inevitable consequences. (*Surgical Obs. Vol. 1, p. 157.*) The same author describes inflammation of the spinal marrow as "attended with an almost universal nervous irritation, which is presently followed by excitement of the brain; in the mean time, matter is poured into the sheath of the spinal marrow, and either by its pressure causing palsy, or by its irritation disturbing the function of the part, so as to be attended with the same consequences. The excitement of the brain being followed by effusion, death ensues." (*P. 159.*) Cases are also referred to, where palsy of the lower extremities comes on several months after an injury of the spine, owing to thickening of the membrane of the medulla, or disease of the latter parts itself. Here Mr. C. Bell recommends perseverance in local bleeding and deep issues. (*P. 160.*)

A fracture of the upper cervical vertebræ, or of the processus dentatus, is always suddenly fatal. In such cases, the immediate paralysis of the diaphragm is said to be the cause of instantaneous death. (See also *L. T. Soemmering. Bemerkungen über Verrenkung und Bruch des Rückgraths*, 8vo. Berlin, 1793. *F. A. F. Cuenotte, Diss. Med. Chir. Sistens Casum Subluxationis vertebræ Dorsi cum Fractura complicatæ, post factam repositionem et varia dira symptomata Duodecima denum Septimana funestæ. Argent. 1761.*)

FRACTURES OF THE STERNUM.

The sternum is not frequently broken, and the reason of this fact is imputed to the position of this bone, resting, as it were, upon the cartilages of the ribs, to the several pieces of which it continues to be formed until advanced age, and to its spongy texture. When the accident does occur, it is from the direct application of external violence to the injured part, and hence the fracture is always accompanied with great contusion, or even a wound of the integuments, and more or less injury of the thoracic viscera. As Boyer remarks, the sternum, in consequence of the elasticity of the cartilages of the ribs, may be readily propelled backward by pressure in this direction, and the result is an actual change in the form, and a real diminution of the chest. Now, since this cavity is always accurately filled by its contents, these alterations cannot happen in a considerable and sudden manner, without a risk of the thoracic viscera being contused, and even ruptured. Thus, when the sternum has been fractured by violent blows on the chest, the heart and lungs have been found severely contused, and sometimes lacerated; and there will always be greater danger of such mischief, when the fracture is attended with depression of one or more of the fragments. In some cases, a large quantity of blood is effused in the cellular membrane of the anterior mediastinum, and, in others, the accident is followed by inflammation, and suppuration in the same situation, and necrosis of the broken part of the bone. Since the lungs are also liable to be ruptured by the same force which causes the fracture, or wounded by the depressed pieces of bone, emphysema may become another complication, as we see exemplified in a case related by Flajani. (*Collezione d'Observ. &c. di Chir. T. 3, p. 214, Svo. Roma, 1802.*)

A fracture of the sternum is rendered obvious by the inequalities perceptible, when the surface of the bone is examined with the fingers; by a depression, or elevation of the broken pieces; a crepitus and an unusual moveableness of the injured part in respiration. In many cases, the fracture may be seen, the soft parts being torn, or otherwise wounded. The breathing is difficult, and almost always accompanied with cough, spitting of blood, palpitations, and inability to lie on the back. According to the observations of Petit and Baldinger, several of

these latter symptoms may continue with less intensity, a long while after the fracture is cured. (*Léveillé Nouvelle Doctrine Chir. T. 2. p. 243.*)

Fractures of the sternum, when mere solutions of continuity, only require common treatment; viz. a piece of soap-plaster to the situation of the injury, a roller round the chest, quietude, and bleeding, and a low regimen, with a view of preventing, what may be considered as the most dangerous consequence, inflammation of the parts within the chest.

In cases, attended with great depression of the fractured bone, the necessary incisions should be made, in order to raise with an elevator the portions of the bone driven inward, or to extract with forceps any loose splinters, which seem to be similarly circumstanced. However, it is not often necessary to trephine the sternum, either to raise a depressed portion of the bone, or to give vent to extravasated fluid. In the first of these circumstances, I believe with Mr. C. Bell, that the formal application of the trephine can never be right, or necessary, though the surgeon may be called upon to extract loose splinters. (See *Operative Surgery, Vol. 2, p. 218.*) Such an operation, however, may occasionally be proper when abscesses form under the sternum, or the bone is affected with necrosis, and the natural separation of the diseased parts is likely to occupy a considerable time.

Fractures of the sternum are more frequently produced by gunshot violence, than any other cause, and, in these cases, there are generally many splinters requiring extraction. At the battle of Marengo, the French general Champeux received such a wound, with which he lived nearly a month; the injury was attended with so many splinters, that when they were removed, the pulsations of the heart were visible to a considerable extent. (*Léveillé, Vol. cit. p. 244.*)

The ensiform cartilage, when ossified in old subjects, is liable to fracture. Little more, however, can be done in such a case, than relaxing the abdominal muscles by raising the thorax and pelvis, and then applying a piece of soap-plaster and a roller over the part, for the purpose of keeping it steady. When the blow has been violent, the patient should always be bled.

FRACTURES OF THE RIBS.

These generally happen near the greatest convexity of the bones, several of which are often broken together. The first rib being protected by the clavicle, and the lower ribs being very flexible, are less liable to be fractured, than the middle ones.

When the spicula of a fractured rib is beaten inward, it may lacerate the pleura, wound the lungs, and cause the dangerous train of symptoms attendant on emphysema. (See *Emphysema.*)

A pointed extremity of the rib, projecting inwards, may also cause an extravasation of blood; or, by its irritation, produce inflammation in the chest. A fracture, which is

not at all displaced, is very difficult to detect, particularly in fat subjects; and, no doubt, is very frequently never discovered. The surgeon should place his hand on the part where the patient seems to experience a pricking pain in the motions of respiration, or where the violence has been applied. The patient should then be requested to cough, in which action the ribs must necessarily undergo a sudden motion, by which a crepitus will often be rendered perceptible. All the best practitioners, however, are in the habit of adopting the same treatment, when there is reason to suspect a rib to be fractured, as if this were actually known to be the case by the occurrence of a crepitus, or the projection of one end of the fracture; which, indeed, in the instances which are displaced, makes the nature of the accident sufficiently plain.

A broken rib cannot be displaced either in the direction of the diameter of the bone, or in that of its length. The ribs being fixed posteriorly to the spine, and anteriorly to the sternum, cannot become shortened. Nor can any of the broken pieces become higher, or lower than the other, because the same muscles are attached to both fragments, and keep them at an equal distance from the neighbouring ribs. The only possible displacement is either outward or inward. (Boyer.)

Simple fractures of the ribs, free from urgent symptoms, require very simple treatment. The grand object is to keep the broken bones as motionless as possible. For this purpose, after a piece of soap-plaster has been applied to the side, and over it proper compresses, a broad linen roller is to be firmly put round the chest, so as to impede the motion of the ribs; and compel the patient to perform respiration chiefly by the descent and elevation of the diaphragm. A scapulary will prevent the bandage from slipping downwards. When the fractured part is depressed inward, the compresses should be placed on the anterior and posterior part of the bone. As a roller is apt to become slack, many surgeons, with good reason, prefer a piece of strong linen, large enough to surround the chest, and laced with pack-thread, so as to compress the ribs in the due degree.

When there is reason from the symptoms to think the lungs injured, or disposed to inflame, copious and repeated bleedings should be practised. Indeed, as peripneumony is always liable to succeed the accident, and is a most dangerous occurrence, every person free from debility, either having a broken rib, or supposed to have such, should always be bled in the first instance. The spermaceti mixture, with opium, is an excellent medicine for appeasing any cough, which may disturb the fracture, and give the patient infinite pain.

[FRACTURES OF THE SACRUM.]

Although more superficial than the other bones of the pelvis, the sacrum is less frequently fractured; a fact, explicable, as Boyer

has remarked, by its thickness, its spongy texture, and the advantageous way in which it supports the weight and efforts of the whole trunk. For the sacrum to be broken, the violence must be very great, like that resulting from the fall of a very heavy body, or the passage of a carriage wheel on the convex side of the bone, or a fall from a great height on that part. On the other hand, fractures of the sacrum, when they do happen, are more serious than those of the ossa innominata, because, in addition to the great degree of contusion and laceration, with which they in common with the latter cases are complicated, there is almost always great damage done to the sacral nerves; a kind of injury, which may have fatal consequences. Hence retention of urine, inability to retain this fluid, involuntary discharge of the feces, paralysis of the lower extremities, &c. Another principal danger also depends upon the injury, which the pelvic viscera may have suffered from the same violence which broke the bone.

When the fracture is situated at the upper part of the sacrum, which seldom happens on account of the thickness of the bone in that situation, there is no displacement, unless the bone is smashed, and the fragments are driven inwards by the same force which produced the fracture, a case, which always implies severe injury of the external and internal soft parts. But when the fracture occupies the lower portion of the bone, where it is less thick, the inferior fragment may be displaced inwards, towards the rectum. And, as Boyer observes, fractures of the higher part of the bone are not in general easily detected. (*Traité des Mal. Chir. T. 3, p. 152.*)

When the violence has been such as to make it probable, that it has extended its effects to the pelvic viscera, every means in the power of art must be adopted for the prevention of inflammation. In particular, copious bleeding should be practised, and, if necessary, repeated. Leeches should also be applied to the vicinity of the sacrum, and the parts kept cool with the *lotio pumbi acetatis*. Any difficulty either in the expulsion, or retention of the urine and feces, will likewise claim immediate and constant attention. (See *Urine Retention of; Incontinence of, &c.*) With regard to the particular means for promoting the union of the fractured sacrum, quietude is the most important, and, after the risk of inflammation is over, all that can be done is to apply a piece of the emplastrum saponis to the part, and put a roller round the pelvis, or a T bandage.

FRACTURES OF THE OS COCCYGIS.

Though much slighter than the sacrum, it is less frequently broken, because less exposed to external force, and is capable of a degree of motion, by which it eludes the effect of violence. But, in elderly persons, in whom the different pieces of the os coccygis are connected by ankylosis, a fall on the buttock may fracture this bone. The accident is known by the moveableness of the

fragments, and the acute pain produced when the thighs are moved, the fragments being then disturbed by the action of the glutei muscles, some of whose fibres are attached to them. (*Boyer, T. 3. p. 160.*)

The treatment of fractures of the os coccygis consists in enjoining quietude, employing discutient, or emollient applications, according to the particular state of the soft parts, and taking blood away from the patient; adopting the antiphlogistic regimen, and enjoining the patient to avoid lying on his back, or sitting down. He should also avoid walking, so as to put the glutei muscles into action, which would disturb the broken bone. All formal attempts at reduction are not only useless in respect to the fracture, but highly injurious to the soft parts, which are not in a state to bear handling without ill effects.

FRACTURES OF THE OSSA INNOMINATA.

The situation and shape of the ossa innominata, and the thickness of the soft parts by which they are covered, explain why they are but seldom fractured. When such accidents happen, they are generally produced by the passage of heavy carriage wheels over the pelvis, falls from great heights, the kick of a horse, &c. and are always attended with considerable contusion of the external soft parts, and sometimes with great injury of the pelvic viscera. The anterior superior spinous process of the ilium is sometimes broken off by the kick of a horse. (*Boyer.*)

The two ossa innominata may be broken together; but commonly one of them is thus injured. Most frequently, the fracture takes place in the upper expanded portion of the bone, known under the name of the ilium, though sometimes it happens either in the ischium, or the os pubis. The solution of continuity may be limited to one part of the bone, or extended to several parts of it; and there may be a greater or lesser number of fragments, and these attended, or not, with displacement. In many instances, in which the pelvis has been violently jammed between two bodies, or run over by a heavy carriage, the bones of the pelvis, besides being fractured, are dislocated, some interesting examples of which accident have been recently published. (*A. Cooper's Surgical Essays, Part 1, p. 49, &c.*)

During my apprenticeship at St. Bartholomew's Hospital, several instances occurred, in which the os ilium, os ischium, and os pubis, were found fractured on opening the bodies after death; and, when the great violence necessary to produce the accident is considered, we cannot wonder that the injured state of the pelvic viscera should frequently prove fatal. Fractures of the ossa innominata are unavoidably attended with more or less contusion of the soft parts on the outside of the pelvis, and when the violence has been very great, the pelvic viscera may be seriously bruised, crushed, or lacerated; and the large nerves, contained in the pelvis, or the spinal marrow itself, inju-

red: hence, extravasation of blood in the cellular membrane of the pelvis, ecchymoses deeply situated even in the substance of the muscles, or other organs, injury of the kidneys; complete loss of motion, a paralysis of the lower extremities; discharge of blood, or a black bilious matter by vomiting, or stool either immediately, or at more or less distant periods from that of the accident; retention of urine; fever; painful tension of the abdomen, from inflammation of the peritoneum and bowels; the formation of abscesses, which are sometimes of great extent; sloughing; and death. (*Boyer, Traité des Mal. Chir. T. 3, p. 154.*)

As the same author has observed, the violence, occasioning a fracture of the ossa innominata, may produce a displacement of the fragments, and carry them more or less away from their natural situation. When the pubes, or ischium, is broken, the splinters may be propelled into the canal of the urethra, or even through the bladder, and give rise to extravasation of the urine, or by merely compressing these organs, this may cause more or less interruption of their functions. But, unless the fragments be displaced by the same force, which caused the fracture, they can hardly be drawn out of their place by any other circumstance, since they are retained by the muscles being attached to both fragments, and by surrounding ligamentous expansions.

Owing to the deep situation of fractures of the pelvis, and to there being no displacement, nor mobility of the fragments, the diagnosis is sometimes attended with great difficulty. A suspicion of the accident may be entertained, when the pelvis has suffered great violence, the patient experiences great agony, and all motion of the trunk and lower extremities is difficult and painful. Under these circumstances, if the fracture should be in the ilium, especially its upper and front portion, or in the os pubis, the mobility of the fragments, or even a crepitus, may be distinguished in a thin subject, if when he is lying horizontally, with his thighs and legs bent, and his head and chest elevated, the projecting part of the os innominatum be taken hold of, and an attempt be made to move the fragments in opposite directions. In this business, however, one caution is given by Boyer, viz. not to mistake the crepitation of an emphysema, often attending large extravasations of blood, for the grating of the fractured bone.

In cases, in which the fracture affects a part of the os innominatum very deeply placed, and it is limited to a single point of the os pubis, or the ischium, so that no detached moveable fragment has been produced, the exact nature of the case is rarely made out with certainty, before the patient's death, and the dissection of the parts.

Fractures of the ossa innominata may be generally deemed cases, accompanied with serious danger. When the fragments are displaced, and do not admit of being rectified again, the disorder arising from this cause, may have fatal consequences. And

as Boyer observes, even when such displacement does not exist, these fractures are not the less to be apprehended, on account of the injury, which the spinal marrow and the nerves, vessels, muscles, and viscera within the pelvis are likely to have sustained. These complications, which are almost inseparable from the fracture, may prove indeed directly fatal, or destroy the patient at a period more or less remote from the time of the accident. Sometimes, however, the fracture is not extensive, and the violence, which produced it, has not caused any very serious injury of the soft parts: but examples of this kind are uncommon.

In these last cases, which are the most simple, a cure of the fracture may be easily effected by means of rest; a position in which all the chief muscles attached to the pelvis, are relaxed; discutient applications; and a roller, or T bandage. (Boyer, *Traité des Mal. Chir.* T. 3, p. 156.) The grand indication is to obviate the consequences of inflammation of the parts within the pelvis, and even of the peritonæum and abdominal viscera, by copious and repeated blood-letting. Any complaints; respecting the evacuation of the urine and feces, must also receive immediate attention. When there is great contusion, and the bones are very badly broken, the patient cannot move nor go to stool, without suffering the most excruciating pain. To afford some assistance in such circumstances, Boyer, in a particular case, passed a piece of strong girth web under the pelvis, and, collecting the corners into one, fastened them to a pulley suspended from the top of the bed. This enabled the patient to raise himself with very little efforts, so that a flat vessel could be placed under him. It appears to me, that a bed, constructed on the principles recommended by the late Sir James Earle, might be of infinite service in these cases, as well as in many others, particularly compound fractures and paralytic affections from diseased vertebræ. (See *Observations on Fractures of the Lower Limbs; to which is added, an account of a contrivance to administer cleanliness and comfort to the bed-ridden; by Sir J. Earle, 1807.*) Mr. Earle has also exerted his mechanical ingenuity with great success in the invention of a bed, admirably well calculated for the treatment of fractures, and other cases, in which it is an object of high importance, to enable the patient to empty the bowels without changing his position.

Sometimes, notwithstanding the rigorous adoption of antiphlogistic measures, abscesses cannot be prevented from forming in the pelvis; particularly, when there are detached splinters driven inwards. These collections of matter should be opened, as soon as a distinct fluctuation can be felt. The splinters may wound the urethra or bladder, and cause an extravasation of urine. Desault extracted a splinter, which had had this effect, from the bottom of a wound, made for the discharge of the effused urine. In these cases, a catheter should be kept introduced, in order to prevent the urine from collecting in

the bladder, and afterward insinuating itself into the cavity of the abdomen. (*Chopart.*) The possibility of mistaking a fracture of the acetabulum for a dislocation of the thigh-bone, and the differences of these cases, as explained by Mr. A. Cooper, have been mentioned in the article *Dislocation*.

FRACTURES OF THE THIGH.

The os femoris is liable to be broken at every point, from its condyles to its very head; but it is at the middle third of this extent, that fractures mostly occur. The fracture is sometimes transverse, but more frequently oblique. The latter direction of the injury makes a serious difference in the difficulty of curing the case, without future deformity or lameness. Sometimes the fracture is comminuted, the bone being broken in more places than one; and sometimes the case is attended with a wound, communicating with the fracture, and making it what is termed *compound*. As Petit remarks, however, the thigh-bone is less seldom broken into several pieces, than other bones more superficially situated.

A fractured thigh is attended with the following symptoms; a local acute pain at the instant of the accident; a sudden inability to move the limb; a preternatural mobility of one portion of the bone; sometimes a very distinct crepitus, when the two ends of the fracture are pressed against each other; deformity, in regard to the length, thickness, and direction, of the limb. The latter change, viz. the deformity, ought to be accurately understood; for, having a continual tendency to recur, especially in oblique fractures, our chief trouble in the treatment is to prevent it. (*Desault, par Bichat, T. 1, p. 181.*)

Almost all fractures of the thigh are attended with deformity. When this is considered, in relation to length, it appears, that, in oblique fractures, the broken limb is always shorter than the opposite one; a circumstance denoting, that the ends of the fracture ride over each other. We may also easily convince ourselves, by examination, that the deformity is owing to the lower end of the fracture having ascended above the upper one, which remains stationary. What power, except the muscles, can communicate to the lower portion of the fractured bone, a motion from below upwards? At one end, attached to the pelvis, and, at the other, to this part of the bone, the patella, the tibia, and fibula, they make the former insertion their fixed point, and drawing upward the leg, the knee, and the lower portion of the thigh, they cause directly, or indirectly, the displacement in question. In producing this effect, the triceps, semitendinosus, semi-membranosus, rectus, gracilis, sartorius, &c. are the chief agents.

For the purpose of exemplifying the power of the muscles to displace the ends of the fracture, mention is made, in Desault's works by Bichat, of a carpenter, who fell from a scaffold, and broke his thigh. The

limb, the next day, was as long as the other; but the man had a complete palsy of his lower extremities, and could not discharge his urine. The moxa was applied, the muscles soon regained their power, and then the shortening of the limb began to make its appearance.

Besides the action of muscles, there is another cause of displacement. However firm the bed may be, on which the patient is laid, the buttocks, more prominent than the rest of the body, soon form a depression in the bedding, and thence follows an inclination in the plane on which the trunk lies, which, gliding from above downward, pushes before it the upper end of the fracture, and makes it ride over the lower one. The muscles, irritated by the points of bone, increase their contraction, and draw upward the lower part of the bone; and, from this double motion of the two ends of the fracture in opposite directions, their riding over each other results. (*Desault, par Bichat, T. 1, p. 183, 184.*)

Transverse fractures are less liable to be displaced in the longitudinal direction of the bone, because, when once in contact, the ends of the fracture form a mutual resistance to each other; the lower end, drawn upward by the muscles, meets with resistance from the upper one, which being itself inclined downward by the weight of the trunk, pushes the former before it, and thus both retain their position in relation to each other.

The deformity of a fractured thigh, in the transverse direction, always accompanies that which is longitudinal; but, sometimes, it exists alone. This is the case, when, in a transverse fracture, the two ends of the bone lose their contact; one being carried outward, the other inward; or, one remaining in its place, while the other is separated. The upper end of the fracture is not now, as in the foregoing instance, motionless in regard to the muscular action; the contraction of the pectineus, psoas, iliacus internus, and upper part of the triceps, draws it from its natural direction, and contributes to displace it.

The deformity of the limb, in regard to its direction, is either the consequence of the blow, which produced the fracture, or, what is more common, of the ill-directed exertions of persons who carry the patient. Thus we see, that an injudicious posture bends the two portions, so as to make an angle.

Whatever may be the kind of deformity, the lower end of the fracture may retain the natural position in which it is placed, or else undergo a rotatory motion on its axis outward, which is very common, or inward, which is more unusual. This rotation always aggravates the displaced state of the fracture, and should be attended to in the reduction. (*Desault, par Bichat, T. 1, p. 185.*)

Every one at all initiated in the surgical profession knows, that there are two very different methods of treating fractured thighs. In one, which was recommended and prac-

tised by Desault, and is still universally preferred in France, the limb is kept in a straight extended position. In the other, the limb is laid upon its side, with the knee bent, a mode, which was extolled by the celebrated Mr. Pott, and since his time has found many partisans in this country. To these two positions for fractured thighs may now be added that, in which the patient lies upon his back, with his thigh and leg in the bent position, supported on two oblique planes, or surfaces, the apex, or angle of which is beneath the ham. This last position, however, has been more particularly recommended for fractures of the neck of the femur, though, if it be advantageous for them, I see no reason for not giving it a fair trial in other fractures of that bone.

That Mr. Pott has lost sight of certain advantages of the straight position; that he was blind to the imperfections of the bent posture; and that he exaggerated the power, which we have of relaxing all the muscles of a limb by position; few reflecting surgeons of the present day will be inclined to deny.

Were we to resign the privilege of thinking for ourselves, and implicitly to mould our opinions, according to any authority, however high, we should often fall into very avoidable errors. Were we to believe the literal sense of several passages in Mr. Pott's remarks upon fractures, we should suppose it possible and practicable to relax at once, by a certain posture of the limb, every muscle connected with a fractured bone. In the first vol. of his works, page 389, edit. 1783, he observes, in speaking of what must best answer the purpose of incapacitating the muscles from displacing the fracture: "Is it not obvious, that putting the limb into such position as shall relax the whole set of muscles, belonging to, or in connexion with, the broken bone, must best answer such purpose?" and, in the next page, "What is the reason why no man, however superficially acquainted with his art, ever finds much trouble in setting a fractured os humeri? is it not because both patient and surgeon concur in putting the arm into a state of flexion, that is, into such a state as relaxes all the muscles surrounding the broken bone?" Also in page 393, he continues, "Change of posture must be the remedy, or rather the placing the limb in such manner as to relax all its muscles." That to have all the muscles relaxed in cases of fracture would be desirable, were it also practicable; every one will admit; but the possibility of accomplishing it, so long as different muscles have different uses, different situations, and different attachments to the bones, every one must grant to be no more than visionary. For instance, do not the patient and surgeon, in the case of fractured os humeri, adverted to above, rather concur in putting the fibres of the triceps and anconeus into a state of tension, at the same moment that they relax the biceps and brachialis internus?

The position of the fractured os femoris.

says Mr. Pott, should be on its outside, resting on the great trochanter: the patient's whole body should be inclined to the same side; the knee should be in a middle state between perfect flexion, or extension, or half bent; the leg and foot lying on their outside also, should be well supported by smooth pillows, and should be rather higher in their level than the thigh; one very broad splint of deal, hollowed out and well covered with wool, rag, or tow, should be placed under the thigh, from above the trochanter quite below the knee; and another somewhat shorter should extend from the groin below the knee on the inside, or rather in this posture on the upper side. The bandage should be of the eighteen tail kind, and when the bone has been set, and the thigh well placed on the pillow, it should not without necessity, (which necessity in this method will seldom occur) be ever moved from it again, until the fracture is united; and this union will always be accomplished, in more or less time, in proportion as the limb shall have been more or less disturbed. (Pott.)

Here only two splints are mentioned; the surgeons of the present day usually employ four. After placing the patient in a proper position, the necessary extension is to be made. Then the under-splint, having upon it a broad soft pad, and an eighteen-tailed bandage, is to be laid under the thigh, from the great trochanter to the outer condyle. The surgeon, before applying the soap plaster, laying down the tails of the bandage, and putting on the other three splints, is to take care that the fracture lies as evenly as possible.

In the position for a fractured thigh, Mr. Pott, we find, directs the leg and foot to be rather higher in their level than the thigh; with what particular design, I have not myself been able to make out. Whoever meditates upon the consequence of elevating the leg and foot above the level of the thigh, in the bent position, will know, that it is to twist the condyles of the os femoris more outward than is natural. When a patient is placed, according to Mr. Pott's direction, upon a common bed, the middle soon sinks so much that the leg becomes situated very considerably higher than the thigh, and I am disposed to think that this is one cause, why so many broken thighs are united in so deformed a manner, that the foot remains permanently distorted outward. The great propensity of the triceps, and other muscles to produce this effect, may also serve to explain the frequency of the deformity. It is not merely the depression of the middle of the bed which is disadvantageous: as the weight of the patient's body falls more upon one side of the bed, than the other, in the bent position of the limb, unless the sacking be tight and the mattress very firm, it happens, that such a declivity is formed, as to render it exceedingly difficult, if not impracticable, to make the patient continue duly upon his side. It cannot be enjoined too forcibly, that fractured thighs should always

be laid upon beds not likely to sink much. When this happens, no rational dependence can be put in the efficacy of the bent position, and, as Desault has explained, the same thing is hurtful also in the straight posture.

The most enthusiastic advocates for the bent position must allow, that it leaves the leg and foot too moveable and unsupported, and that though it may relax the muscles, which have the most power to disturb the coaptation of a fractured thigh, it yet leaves a mass of muscle unrelaxed, quite sufficient to displace the ends of the bone. Hence, practitioners should endeavour to improve the apparatus employed, so that it may make a permanent resistance to the action of the muscles, and in the straight position such resistance may certainly be practised with most effect and convenience.

The whole tenor of Mr. Pott's observations on fractures would lead one to suppose, that from the moment a muscle is partially relaxed, it becomes incapable of acting on, or displacing a fracture. But, if this were correct, (which it cannot be) we should not have the power of completely bending, or extending our limbs; for as soon as the set of muscles, designed for this purpose, were partly relaxed by the half-flexion, or half-extension of the joint, they would be deprived of all further power. Therefore, in addition to the arguments to be brought against the bent posture, arising from its not actually relaxing all the muscles connected with the broken bone, we are also to take into the account the fact, that the partial relaxation of any muscle by no means incapacitates it from acting.

In the earlier editions of this Dictionary, I expressed a preference to Mr. Pott's method of treating broken thighs. More mature reflection, however, and subsequent experience, have made me a convert to the sentiments of Desault on this subject. The terrible compound fractured thighs, which I had under my care in the campaign in Holland in the year 1814, could not have been at all retained by any apparatus put merely upon the thigh itself. The superiority of long splints, extending the whole length of the limb, was in these cases particularly manifest. With such splints, which maintain steady the fracture itself, the knee, leg, ankle, and foot, your patient may, in fact, even be removed upon an emergency from one place to another, without any considerable disturbance of the broken part. But, how could this be done in the bent position, with short splints, merely applied to the thigh, affording no support to the leg, and not confining the motions of the knee, and foot?

There are some excellent remarks on the treatment of fractured thighs in *Les Œuvres Chirurgicales de Desault par Bichat*. It is observed, that, if we compare the natural powers of displacement with the artificial resistance of almost every apparatus, we shall find, that the disproportion between such forces is too great to let the former

yield to the latter. The action of the muscles, however, which is always at first very strong, may afterward be gradually diminished by the extension exercised on them. A power incessantly operating can effect, what another greater power temporarily applied, cannot at once accomplish; and the compression of circular bandages tends also to lessen the force of the muscles.

Desault cured in the Hôtel Dieu an immense number of fractured thighs, without any kind of deformity. It was particularly to the well-combined employment of extension and compression of the muscles, that such success was owing. The advantage of keeping the muscles a long while extended, in order to diminish their power, is especially evident in the reduction of certain dislocations, as those of the shoulder, in which we often cannot succeed till the muscles have been kept on the stretch for a greater or lesser time. The fracture of the patella and olecranon equally demonstrates the utility of compression for the same purpose; as when the muscles are not compressed by the bandage, they draw upward the fragment of bone with double or triple force.

Against reducing fractured thighs in the bent posture, Desault entertained the following objections: the difficulty of making the extension and counter-extension, when the limb is so placed; the necessity of then applying them to the fractured bone itself, instead of a situation remote from the fracture, as, for example, the lower part of the leg; the impossibility of comparing with precision the broken thigh with the sound one, in order to judge of the regularity of its shape; the irksomeness of this position long continued, though it may at first seem most natural; the inconvenient and painful pressure of a part of the trunk on the great trochanter of the affected side; the derangement, to which the limb is exposed when the patient has a motion; the difficulty of fixing the leg firmly enough to prevent the effect of its motion on the thigh-bone; the manifest impossibility of adopting this method, when both thighs are fractured; lastly, experience in France having been little in favour of such posture.

Also, what is gained by the relaxation of some muscles, is lost by the tension of others. For such reasons, (certainly strong ones,) Desault abandoned the bent position, and always employed the straight one, which was advised by Hippocrates, and all the Greek physicians.

Petit, Heister, and Duverney, recommended applying the extending means just above the condyles of the os femoris. Dupouy was one of the first to remark, that this practice rendered it necessary to employ very great force, and that it would be better to make the extension from the foot. Fabre takes into consideration also the inconvenience of the pressure, made on the muscles, which, irritating and stimulating them to action, multiplies the obstacles to setting the fracture. For nearly similar motives, Desault espoused their doctrine,

introduced it at the Hôtel Dieu, and the success which he experienced from the practice, contributed materially to its more extensive adoption.

Desault, as we have stated, preferred the straight posture, and laid his patients on surfaces, not likely to sink with the weight of the body. The feather beds, formerly in common use at the Hôtel Dieu, had this inconvenience; for these, in cases of fractures, Desault substituted a firm, tolerably hard mattress, which did not allow the continual change of posture to occur, which a soft bed does. The object of every apparatus being to keep the ends of the fracture from being displaced, the mechanism of every contrivance, for this purpose, should be directed against the causes of the displacement. These are, 1. the action of the muscles, drawing upward the lower end of the fracture; 2. the weight of the trunk propelling downward the upper end. Hence, every apparatus, intended to prevent displacement of a thigh fractured obliquely, should, 1. draw and keep downward the lower end of the fracture; 2. carry and maintain upward the upper end of the fracture, and the trunk, which is above it. This principle is of general application, and only subject to a few exceptions in transverse fractures, attended merely with displacement in the direction of the diameter of the limb, or else none at all. 3. There must also be in the apparatus a resistance to the rotation of the lower portion of the broken bone, so as to keep the limb steady, even in case of any sudden motion.

If we compare the operation of the different pieces of our apparatus with the above indications, we shall find, that without permanent extension, they are not very effectual. With regard to bandages, whether a roller or eighteen-tailed bandage, be used, they all have one common mode of operating; they press the muscles towards the ends of the fracture, so as to make them form a kind of natural case for the fracture, and thus they make lateral resistance against the parts. In this manner, bandages materially aid in preventing displacement sideways, and are particularly useful in transverse fractures. But, what is there to hinder the two inclined surfaces of an oblique fracture from slipping one over the other? What power is there to keep the limb from receiving the effects of accidental shocks? Is the pelvis kept back? Is the action of the muscles resisted? The latter is indeed somewhat diminished by the pressure, and this is the chief use of the bandage: but, will such compression be enough to prevent the longitudinal displacement of the broken bone, especially, if the bandage be applied slackly, as some advise?

These remarks apply also to compresses; *petit moyen contre une grande cause.*

Splints are useful in firmly fixing the limb, and guarding it from the effects of accidental shocks, or of contractions of the muscles. They operate more powerfully than bandages, in preventing lateral displacement,

and hence, they suffice for transverse fractures, without permanent extension. They also resist the rotation of the thigh outward, or inward. But when the breach of continuity is oblique, will they hinder the ends of the bone from gliding over each other, and the consequent shortening of the limb? They obviously could only do so, by the friction of the different pieces of the apparatus, especially the tapes, which fasten it, and then, to make the resistance effectual, they must be tied so tightly as to create danger of mortification. Will the splints prevent the trunk from descending, and propelling before it the upper end of the fracture? Will they hinder the action of the muscles on the lower end? Will they, in short, fulfil all the above indications? Their chief use is to prevent lateral displacement, and keep the limb steady. Hence, they should extend along the leg, as well as the thigh, which cannot fail to be disturbed whenever the lower part of the limb is allowed to move.

The pads serve principally to keep the limb from being galled by the splints, and their action in preventing displacement of the fracture must be but trivial.

According to Desault, the ordinary pieces of apparatus, which do not execute any permanent extension, may suffice for transverse fractures; but they are always ineffectual, when the division is oblique, because they do not fulfil the twofold indication of drawing downward the lower end of the fracture, and keeping the other one upward.

Desault ascertained that the object particularly to be aimed at, was such a disposition that the foot, leg, thigh, and pelvis, should constitute but one whole; so that, though the different parts thereof might be drawn in different directions, yet they would still, with respect to one another, preserve the same mutual relation. He invented the following apparatus to answer these purposes.

A strong splint, long enough to extend from the ridge of the os ilium to a certain length beyond the sole of the foot, is a principal part of this apparatus: this splint should be two inches and a half broad, each of its extremities being pierced in the form of a mortice, and terminating in a semicircular niche. It is applied to the exterior side of the thigh, by means of two strong linen bands, each being more than a yard long.

The middle part of one of these bands is to be applied to the inside of the thigh, at its upper part; its ends are brought to the exterior side of the thigh, passed through the mortice, and knotted on the semicircular niche. Compresses are to be previously placed under the middle part of the band, in order to prevent any disagreeable pressure; as well as on the tuberosity of the ischium, which Desault considered as the principal point of action of this band. The inferior part of the leg is next covered with compresses, on which the middle part of the

second band is placed: the extremities of this band cross on the instep and upper part of the foot, then on the sole, after which they are conveyed outward, and one end passed through the mortice and knotted with the other on the niche, with such a degree of force as to pull the inferior portion of the femur downward, and push the splint upward, and by this means, the pelvis, and superior portion of the fractured bone. On the internal side of the limb is placed a second splint, which extends from the superior part of the thigh, to a certain distance beyond the foot. A third is placed on the anterior part of the limb from the abdomen to the knee. The superior extremities of the anterior and exterior splints are fixed by means of a bandage passed round the pelvis. A band, the middle part of which is placed under the sole of the foot, and the extremities crossed on its superior surface, and fastened to the splints, operates with them in preventing the foot from moving.

Before applying the apparatus, Desault covered the whole limb with compresses, wet with a solution of the acetite of lead. Over these, Scultetus's bandage was put, and a roller round the foot, all wet with the same lotion. For more particulars, the reader is referred to the *Parisian Chirurgical Journal*, Vol. 1; *Œuvres Chir. de Desault par Bichat*, T. 1; *Rosolino Giardina Memoria sulla Fratture, con alcune Modificazioni all' Apparatto di Desault*. Seco. Palermo, 1814. Boyer, *Traité des Maladies Chir.* T. 3; *Richerand, Nosogr. Chir.* T. 3, Edit. 4. Boyer's apparatus for fractured thighs is described in the 2d vol. of the *First Lines of the Practice of Surgery*, ed. 4.

Instead of the position advised by Pott, or that recommended by Desault and Boyer, Mr. C. Bell prefers the posture, in which the patient lies upon his back, with the limb supported in the bent attitude by means of a wooden frame. This machine is simple enough, consisting of boards, ten or eleven inches in breadth, one reaching from the heel to the ham, the other from the ham to the tuberosity of the ischium. Under the knee-joint, they are united at an angle, while a horizontal board connects their lower ends together. Thus they form two sloping surfaces, to which cushions are adapted, and over which the limb can be placed in an easy bent position. Near the edge of the inclined boards, holes are made, furnished with pegs. After the bone has been set, a long splint is applied from the hip to the side of the knee, and another along the inside of the thigh. (See *Operative Surgery*, Vol. 2, p. 189.) I entertain a very favourable opinion of this mode of placing fractured thighs. However the foregoing apparatus does not sufficiently secure the leg and foot from motion, though with the aid of a roller and a foot-board, this advantage might easily be obtained. The fracture apparatus, devised by my friend Mr. Earle, is excellently calculated for this mode of treatment, with these additional recommendations, that the obliquity of the two

surfaces, on which the limb reposes, can be altered as occasion may require; there is a foot-board for the support of the foot, and a contrivance, by which the patient is enabled to have stools, without moving himself or changing his posture in the slightest degree.

Fractures of the Neck of the Thigh-bone.

These accidents are infinitely more frequent, than dislocation of the thigh-bone, and are divisible into two kinds: first, that in which the neck of the bone is broken within the capsular ligament; and secondly, that in which the fracture happens externally to this ligament, either through the root of the neck of the bone, or through the trochanter major. (*A. Cooper, Surgical Essays, Part 2, p. 30.*)

The neck of the thigh-bone may be fractured either by a fall on the great trochanter, the sole of the foot, or the knee. According to Desault, the first accident produces the injury much more frequently, than the two latter. Of thirty cases, which were seen by Desault, four-and-twenty arose from falls on the side. All those inserted by Sabatier in his interesting Memoir, were the result of a similar accident. These statements, however, do not exactly coincide with the experience of Mr. A. Cooper, who observes, that in London, the accident is most commonly produced by a person slipping off the edge of the foot pavement. According to this eminent surgeon, a fracture of the neck of the thigh-bone, within the capsular ligament, seldom happens but at an advanced period of life, and the reason of the facility, with which the injury takes place in old persons, he ascribes to the interstitial absorption, which that part of the femur undergoes in individuals past a certain age, whereby it becomes shortened, and altered in its angle with the shaft of the bone. Mr. A. Cooper admits, however, that the accident is frequently caused by a fall upon the trochanter major. (*Surgical Essays, Part 2, p. 35, 36. Also Larrey, Journ. Complém. T. 8, p. 98, 8vo. Paris. 1820.*) Fractures of the neck of the thigh-bone are said to be more common in women, than men. (*J. Wilson on the Skeleton, &c. p. 245.*)

The division is seldom oblique, almost always transverse; the neck being sometimes, in the latter case, wedged in the body of the bone, as Desault found in several instances; a model of one of which, in wax, is preserved in the collection of *L'Ecole de Santé*, and the natural specimen of which was in the possession of Bichat. The fracture of the neck of the thigh-bone is sometimes complicated with that of the trochanter major.

The diagnosis is occasionally so difficult, that the best informed practitioners cannot always detect the accident with certainty. At the instant of the fall, an acute pain is felt, (sometimes a crack is distinctly heard) and a sudden inability to walk occurs; and the patient cannot raise himself from the ground. The latter circumstance, however,

is not invariable. In the fourth vol. of the *Mem. de l'Acad. de Chirurgie*, a case is related, in which the patient walked home after the accident, and even got up the next day. Desault published a similar example. The locking of one end of the fracture in the other, may offer an explanation of this circumstance. The dissections made by Dr. Colles, have recently led to another discovery, viz. that sometimes the solution of continuity does not extend completely through the neck of the femur. (*See Dublin Hospital Reports, Vol. 2.*) Three cases proving this are there adduced; a fact, which at once explains the ability of some patients to walk directly after the injury, and the absence of all retraction of the limb.

A shortening of the limb almost always takes place; but this symptom is more or less striking, according as the breach of continuity is out of the cavity of the orbicular ligament, which then cannot keep the bone from being retracted; or as the extremity of the fracture is confined by this ligament. The action of the muscles drawing upward the lower end of the fracture, the weight of the trunk in propelling downward the pelvis and upper end of the fracture, are the two causes of the shortening of the limb. In general, a slight effort suffices for the restoration of the natural length of the limb; but the shortness recurs almost as soon as the extension ceases. "This evidence of the nature of the accident continues," as Mr. A. Cooper correctly remarks, "until the muscles acquire a fixed contraction, which enables them to resist any extension, which is not of the most powerful kind." (*Surgical Essays, Part 2, p. 31.*) Goursault and Sabatier remark, that sometimes the shortening of the member does not take place till a long while after the accident. In opposition to the common belief, that the limb is shortened, Baron Larrey asserts, that the member is at first actually lengthened. (*Journ. Complém. T. 8, p. 99.*) This statement I have never seen confirmed, and it is contradicted by daily experience. And to prove how widely Larrey differs from Mr. A. Cooper, the following passage will suffice. "In order to form a still more decided judgment of this accident (says the latter writer) after the patient has been examined in the recumbent posture, let him be directed to stand by his bed-side, supported by an assistant, so as to bear his weight upon the sound limb. Immediately he does this, the surgeon observes most distinctly the shortened state of the injured leg, the toes resting on the ground, but the heel not reaching it, the everted foot and knee, and the diminished prominence of the hip." (*Surgical Essays, Part 2, p. 34.*) A swelling is observable at the upper and front part of the thigh, always proportioned to the retraction, of which it appears to be an effect.

The projection of the great trochanter is almost entirely effaced. Directed upwards and backwards, this eminence becomes ap-

proximated to the crista of the os ilium; but, if pushed in the opposite direction, it readily yields; and, when it has arrived at its natural level, the patient becomes capable of moving his thigh.

The knee is a little bent. Abduction of the limb always occasions acute pain, and it is noticed by Mr. A. Cooper, that the rotation inwards is particularly painful, because the broken extremity of the bone then rubs against the capsular ligament. (*Vol. cit. p. 33.*) If, while the hand is placed on the great trochanter, the limb is rotated on its axis, this bony projection may be felt revolving on itself, as on a pivot, instead of describing, as in the natural state, the segment of a circle, of which the neck of the femur is the radius. This symptom, which was particularly noticed by Desault, is very manifest when the fracture is situated at the base of the neck, less so when at its middle; and it is not very perceptible when the breach is near the head of the bone. In the rotatory motions, the lower fragment, rubbing against the upper one, produces a distinct crepitus, which, however, is not an invariable symptom, as Larrey would lead one to suppose.

As Mr. A. Cooper observes, no crepitus can be felt while the patient is lying upon his back with the limb shortened; but, if the leg be drawn down, it may sometimes be distinguished, especially when the limb is rotated inwards. (*Surgical Essays, Part 2, p. 34.*)

The toes are usually turned outward; a position which Sabatier considers as the inevitable effect of the fracture, though Paré and Petit noticed, that it did not constantly occur. Two cases, adduced by these illustrious surgeons, were not credited by M. Louis; but the experience of Desault fully confirmed the possibility of the limb not being always rotated outwards. And, as Mr. A. Cooper has remarked, three or four hours generally elapse before the turning of the limb outward is rendered most obvious by the fixed contraction of the muscles, (*Surgical Essays, Part 2, p. 32.*)

The position of the toes outward is commonly, and I believe correctly, imputed to the rotator muscles. Bichat conceived, however, that if this doctrine were true, such position ought always to exist; and he reminds us, that all the muscles, which proceed from the pelvis to the trochanter, are, with the exception of the quadratus, in a state of relaxation, by the approximation of the femur to their point of insertion; and that the contracted muscles would not allow the foot to be so easily turned inward again. Hence, Bichat thought it probable, that the weight of the foot itself may pull the limb into the position, in which it is commonly found: On the other hand, it is remarked by Mr. A. Cooper, that any one may satisfy himself, that the rotation of the limb outwards is in part owing to the muscles, by feeling the resistance, which is made to rotation inwards, which resistance, however, he

thinks may in some measure depend upon the length of the portion of the neck of the femur, which remains attached to the trochanter major, and rests against the ilium. (*Surgical Essays, Part 2, p. 32.*)

It follows from the preceding account, that none of the symptoms of a fracture of the neck of the thigh-bone are exclusively characteristic; that each, considered separately, would be insufficient, and that their assemblage can alone throw light on the diagnosis. In every instance of doubt, however, the safe course must be pursued, and the apparatus applied, which, though useless, is not dangerous, should the injury not exist, and is indispensably necessary when it does. (*Desault, par Bichat, T. 1, p. 219—226.*)

It was at one time supposed, that fractures of the neck of the thigh-bone could not be cured, without some shortening of the limb, and lameness. Ludwig, Sabatier, and Louis, broached this doctrine, and imputed the circumstance to the destruction of the neck of the bone. That this sometimes happens has been well ascertained. A late Surgical visiter to Paris informs us, that, in several specimens, which he examined in different museums, whether imperfect union, or no union at all, had followed the fracture, this absorption of the neck of the bone had taken place to a great extent, and in some to so great an extent, that the articulating surface of the bone, which plays in the acetabulum, rested between the trochanters, consolidated to the body of the bone by ligamentous union, and the thickening of the surrounding parts, whilst all the intervening neck of the bone was absorbed. (*See Sketches of the Medical School of Paris, by J. Cross, p. 90.*) M. Roux has also nearly always found the neck of the femur shortened and deformed after its reunion. (*Parallèle de la Chir. Angloise avec la Chir. Francoise, p. 178.*) Desault, however, is said to have rarely met with instances of lameness from such a cause in his practice.

A question, that has lately been much agitated, is, whether reunion by bone ever follows cases, in which the fracture is entirely within the capsule, and the head of the bone insulated, except at its attachment to the acetabulum by the round ligament? The French surgeons decide in the affirmative, and pretend actually to demonstrate the fact by preparations in their museums. M. Roux, indeed, was good enough to send over a specimen to Mr. A. Cooper, with the hope of producing conviction; but, this eminent surgeon still remains unconvinced, because the traces of reunion in the preparation appear to him to indicate a sort of fracture, where the internal fragment still retained some connexion with the capsular ligament. (*Roux Parallèle de la Chirurgie Angloise, &c. p. 179, 180.*) In fact, it was a case, in which the fracture had happened at the junction of the cervix with the trochanter. And Mr. A. Cooper in his last valuable publication distinctly states, that, in all the exa-

minations which he has made of *transverse fractures of the cervix femoris, within the capsular ligament, he has never met with a bony union, or of any which did not admit of motion of one bone upon the other.* (*Surgical Essays, Part 2, p. 39.*) By this eminent surgeon, the want of bony union is referred to the fragments not being in contact and duly pressed against each other, and to the little action in the head of the bone separated from the cervix, "its life being supported solely by the ligamentum teres, which has some few vessels ramifying from it to the head of the bone." For the particular appearances found in the dissection of these cases, I must refer to the statements of Dr. Colles. (*Dublin Hospital Reports, Vol. 2.*) and to Mr. Cooper's own account, from which it seems, that "no ossific union is produced; that nature makes slight attempts for its production upon the neck of the bone, and upon the trochanter major; but scarcely any upon the head of the bone; and that, if any union is produced, it is by ligament only." (*Vol. cit. p. 46.*) Mr. Wilson's observations are all in confirmation of the same explanation; (*On the Skeleton, p. 247.*) and he adverts to two preparations, in the museum of the College of Surgeons, which have been supposed to be proofs of a bony reunion of the neck of the femur, subsequently to a fracture within the capsular ligament; but (says Mr. Wilson) "I have very attentively examined these two preparations, and cannot perceive one decisive proof in either of the bone having been actually fractured." One of these cases is that, which was published last year by Mr. Liston in the *Edinb. Med. and Surgical Journ.* Lastly, Dr. Colles of Dublin dissected several cases, in which the neck of the femur had been broken: in one, where the injury was within the capsular ligament, "no effort of nature had been made to create a reunion between the two pieces of the fracture, and the stability of the limb had depended upon the strength of those ligamentous bands, by which each piece was connected with the capsular ligament of the joint, aided, no doubt, by the extraordinary thickness, which the capsular had acquired." (*Dublin Hospital Reports, Vol. 2, p. 336.*) In the two first instances, reported by this author, "The broken surfaces moved on each other, and were converted into a state approaching to ivory. No attempt had been made to reunite the fracture, and the pieces of bone were held in apposition only by new ligamentous productions from the capsular ligament, which were inserted into the external surfaces of each piece. In No. 3, there had been a slight attempt made at reunion. In No. 7, 8, and 9, we observed a phenomenon, which, I believe, is now for the first time mentioned, a fracture of only part of the bone. No. 6 presented us with that mode of reunion, which some have supposed the most perfect, of which this fracture is susceptible. While No. 10 and 11 exhibit a mode of reunion, very little inferior to callus in point of firmness, but very different in its na-

ture, and which I conceive is peculiar to the fracture of the neck of the femur." Dr. Colles also found, that, in all these cases (except, perhaps, No. 5) the capsular ligament was not lacerated. In every instance, however, there was an increased thickness of the capsule, and a removal of all, or the greater part of the neck of the bone. "Although the ligamentous bands seem, in a majority of instances, to have proceeded from the capsular ligament, yet, it is evident from No. 6, that these may arise merely from the broken surfaces of the bone; for, in this case not a single fibre was attached to the capsular ligament, the new bond of union being covered by the reflected portion of the synovial membrane or periosteum of the neck. We have an illustration of this in Ruysch. Tab. 1, Thes. 9." In No. 10 and 11, the fragments were united by a cartilaginous substance. In No. 7, 8, and 9, the unbroken portion of the neck was so softened, that it more resembled cartilage than bone, and, in this state, "it was laid down upon the fractured surface, and united to it." (*Dr. Colles in Dublin Hospital Reports, Vol. 2, p. 353-355.*) In the museum of the Ecole de Médecine at Paris, there are some preparations, which the professors exhibit at their lectures, in order to prove, that bony union may succeed a fracture of the neck of the femur. These specimens were carefully examined by Mr. Cross; but, none of them proved to him, that bony union ever follows where the head of the bone becomes insulated, except its attachment to the pelvis by the ligamentum teres. (*Sketches of the Medical Schools at Paris, p. 93.*) On the other hand, Boyer observes, that experience fully proves the possibility of uniting such fractures of the neck of the thigh bone, as are situated within the capsular ligament; but, he acknowledges, that there are certain circumstances, which may prevent this desirable event. "From all that has been hitherto said on the prognosis of a fracture of the neck of the femur, we may conclude, (says Boyer) that this fracture is more serious, than that of any other part of the same bone, because the difficulty of keeping it reduced is greater. That it may in general be reunited, especially in young healthy subjects; but, more easily, when it is situated near the base of the neck, than near the head of the bone. That the languid vitality of one of the fragments and the impossibility of ascertaining whether the coaptation be exact, make the cure slow, and the time necessary for their consolidation uncertain. That the neglect of means adapted to maintaining the limb in its proper length, and natural straightness, and the fragments sufficiently motionless, may cause them to unite by an intermediate substance. Lastly, that the situation of the fracture near the head of the femur; the complete laceration of the elongation of the capsule investing the neck of the bone; the great age of the patient; and, particularly, the constitution labouring under some diathesis, which affects the osseous system; may render the cure absolutely im-

possible; that, in this circumstance, one of the fragments is more or less destroyed by the friction of the other against it, and in the joint a disease is formed, which tends to carry off the patient." (*Boyer, Traité des Maladies Chirurgicales*, T. 3 p. 284.) This professor lays much stress on the complete laceration of the continuation of the capsule over the neck of the bone, as an occurrence preventive of union. But, he thinks it does not frequently happen, because the capsular ligament hinders much displacement of the fragment. (*Op. cit.* p. 278.) As for Baron Larrey, he appears to entertain no doubt of the possibility of uniting fractures of the neck of the femur within the capsular ligament, and concludes his tract on this subject with the case of General Fririon, who was perfectly cured after a supposed injury of this description. (See *Journ. Complet. Tom. 8*, p. 118.)

How is this discordance between the most experienced French and English surgeons to be reconciled and accounted for? After the very numerous and careful dissections, which have been performed by Mr. A. Cooper and Dr. Colles, with the view of ascertaining the state of the joint, after fractures of the neck of the thigh-bone, little doubt can be entertained that, where the fracture is *transverse and within the capsular ligament*, a bony reunion, if not absolutely impossible, is at least so rare an occurrence as not to be calculated upon. The difference of the French surgeons upon this question is to be ascribed to their not having duly discriminated from the foregoing kind of case, either fractures extending more or less in the direction of the axis of the neck of the bone, or other fractures external to the capsular ligament. How much, however, the safety of the practitioner's reputation will depend upon the prognosis which is given, must be quite evident: for in the *transverse fracture within the capsule*, lameness is sure to follow, though its degree cannot at first be exactly estimated. (*A. Cooper, Surgical Essays, Part 2*, p. 51.)

The following circumstances are enumerated by this author, as forming a criterion of the fracture being external to the capsular ligament. 1. The injury frequently happens in young persons; indeed, it is said, that, when the patient is under fifty, the fracture is generally on the outside of the capsule, and capable of ossific union. 2. Whilst the internal fracture happens from very slight causes, this is produced by severe blows, falls from considerable heights, or by the passage of a carriage-wheel over the pelvis. 3. The crepitus is in general more readily felt, in consequence of their being less retraction of the limb. 4. The trochanter is displaced forwards nearer the spine of the ilium, than natural. 5. The pain of the accident is greater, than when the fracture is within the capsule. 6. The limb is generally less shortened. 7. The limb admits of being rotated with greater facility, there being no remnant of the cervix capable of making re-

sistance by coming in contact with the ilium. (*Vol. cit.* p. 53.)

Having spoken of the nature of fractures of the neck of the thigh-bone, within and without the capsular ligament, I come next to the consideration of the proper practice to be adopted. In the first description of the injury, as no osseous union can be expected, ought we to endeavour to keep the fragments as nearly in a state of apposition as possible, and subject the patient to rest and confinement, with the view of promoting the other modes of union, so well pointed out in Dr. Colles's paper? Or should we, as Mr. A. Cooper does, avoid confining the patient to any long, or continued extension, "as being likely to be productive of ill-health, without the probability of producing union?" Yet it appears both from this gentleman's own statements, and from those of Dr. Colles, that, though a bony union cannot be effected, other connecting means may be established, and the more perfect these are, the less will be the subsequent lameness. As long, therefore, as these facts are incontrovertible, I should be disposed to recommend surgeons to do every thing in their power to keep the limb quiet, and in a desirable posture, for a due length of time. Whether for this purpose, Boyer's apparatus, with the limb in the straight posture; or the apparatus with two inclined surfaces, with the limb in the bent position, and the patient on his back; or lastly, Hagedorn's ingenious and scientific treatment, as explained in the second vol. of the *First Lines of Surgery*, should be preferred, time and experience must determine. Mr. A. Cooper merely places one pillow under the whole length of the limb, and puts another across under the patient's knee, so as to keep the limb in an easy bent position. In a fortnight, or three weeks, the patient is allowed to sit upon a high chair, and in a few more days, he begins to take exercise upon crutches. After a time, these are laid aside, a stick substituted for them, and in a few months this assistance may be dispensed with. At the end of the treatment, a shoe must be worn with a sole of equal thickness to the diminished length of the limb. (*Surgical Essays, Part 2*, p. 50.)

In the treatment of such fractures of the neck of the femur, as are situated on the outside of the capsular ligament, Mr. A. Cooper prefers the position in which the patient lies on his back, with the injured limb in a bent posture, supported on what is termed the double inclined plane, the kind of instrument already spoken of as being sometimes employed by Mr. C. Bell. When the limb has been placed over this machine, in an easy bent position, a long splint, reaching above the trochanter major, is applied to the outer side of the thigh, and fastened to the pelvis with a strong leather strap, so as to press one portion of bone towards the other. The lower part of the splint is also fastened to the outside of the knee with a strap. The limb is to be kept as quiet as possible for eight weeks, at the end of which time the patient may leave his bed, if the attempt

should not cause too much pain; but the splint is to be continued another fortnight. (*Surgical Essays, Part 2, p. 59*) Desault's apparatus has been described in the foregoing columns, and those of Boyer and Hagedorn are explained and represented in the 2d Vol. of the *First Lines of Surgery*.

Larrey, who disapproves of the plan of continued extension, has lately proposed a particular apparatus for fractures of the neck of the femur: but as it appears to me very inferior to other methods already mentioned, I shall here merely refer to the *Journ. Compl. T. 8, p. 116*, where a description of it may be found.

I am glad to find the number of advocates for Pott's method of treatment annually diminishing. Indeed, the bad effects and painful consequences of having the whole weight of the trunk operating upon the fractured ends of the bone, which are often not properly in contact, are too obvious to need any comment. Yet this injudicious pressure is made in the bent position, which also forbids the use of long effective splints, and all assistance from moderate continued extension.

A fracture of the neck of the thigh-bone may be complicated with a dislocation of the head of the bone. (See *J. G. Haase, De Fractura colli Ossis Femoris, cum Luxatione Capitis ejusdem ossis conjuncta, Lips. 1798.*) For further information relative to fractures of the neck of the femur, the following authors may be consulted: *C. G. Ludwig de Collo Femoris ejusque Fractura Programma, Lips. 1755.* Bellocq. in *Mém. l'Acad. de Chir. T. 3.* Aitken's and Gooche's machines are described in *B. Bell's Surgery, Vol. 4.* Sabatier, in *Mém. de l'Acad. de Chir. T. 4.* Duvernoy, *Traité des Mal. des Os, T. 1.* Unger, in *Richter's Bibl. B. 6, p. 520.* Theden, *Neue Bemerkungen, &c. Th. 2.* Brunninghausen ueber den Bruch des Schenkelbeinhalses, &c. *Wurzb. 1789.* Van Gescher ueber die Entstellungen des Ruckgrats, und ueber der Verrenkungen und Bruche des Schenkelbeins. aus d. Holland. Hedenus, in *Bernstein's Darstellung des Chir. Verbandes, Tab. 42, fig. 82 and 83.* M. Hagedorn ueber der Bruch des Schenkelbeinhalses, &c. *Leipz. 1808.* J. N. Sauter, *Anweisung die Beinbrüche der Gliedmassen, vorzüglich die complicierten und den Schenkelbeinhalsbruch nach einer neuen, &c. Methode, ohne Schienen sicher zu heilen. 8vo. Konstanz. 1812.* J. Wilson on the Structure and Physiology of the Skeleton, &c. p. 243, &c. *8vo. Lond. 1820.* Dr. Colles, *Dublin Hospital Reports, Vol. 2.* A. Cooper, *Surgical Essays, Part 2.* Boyer, *Traité des Mal. Chir. T. 3.*

OBLIQUE FRACTURES OF THE EXTERNAL, OR INTERNAL CONDYLE OF THE FEMUR INTO THE JOINT.

In these cases, Mr. A. Cooper prefers the straight position, because the tibia presses the extremity of the broken condyle into a line with that which is not injured. The limb is to be put in the extended posture upon a pillow, and evaporating lo-

tions and leeches are to be used for the removal of the swelling and inflammation. "When this object has been effected, a roller is to be applied around the knee, and a piece of stiff pasteboard, about sixteen inches long, and sufficiently wide to extend entirely under the joint, and to pass on each side of it, so as to reach to the edge of the patella, is to be dipped in warm water, and applied under the knee, and confined by a roller. When this is dry, it has exactly adapted itself to the form of the joint, and this form it afterward retains, so as best to confine the bones. Splints of wood or tin may be used on each side of the joint; but they are apt to make uneasy pressure. In five weeks, passive motion of the limb may be gently begun, to prevent anchylosis." (*Surgical Essays, Part 2, p. 101.*) This author afterward describes a compound fracture of the external condyle, a portion of which was after a time extracted, and the case ended so favourably, that the patient, who was a boy, was able to bend and extend the leg without pain.

For fractures just above the condyles, Mr. A. Cooper recommends the bent position, without which, he says, deformity is sure to follow. He advises the limb to be placed over the double inclined plane, and a roller applied round the lower portion of the femur. (p. 103.)

FRACTURES OF THE PATELLA.

This bone is most frequently broken transversely, and the accident may be occasioned either by the action of external bodies, or by that of the extensor muscles. In the latter case, the fall is subsequent to the fracture, and, as Camper has remarked, it is mostly only an effect of it. For instance, the line of gravity of the body is, by some cause or another, inclined backward; the muscles in front contract to bring it forward again; the extensors act on the patella; this breaks, and the fall ensues. That it is the action of the muscles, and not the fall, which usually breaks the knee-pan, is well ascertained. Sometimes the fracture occurs, though the patient completely succeeds in preventing himself from falling backward, as we find exemplified in two cases lately reported by Mr. A. Cooper. (*Surgical Essays, Part 2, p. 85.*) A soldier broke his patella in endeavouring to kick his serjeant; the olecranon has been broken in throwing a stone. In the operating theatre of the *Hôtel Dieu* both the knee-pans of a patient were broken by the violent spasms of the muscles, which followed an operation for the stone. The force of the muscles occasionally ruptures the common tendon of the extensor muscles, or, what is more frequent, the ligament of the patella. Of these cases, Petit, Desault, and Sabatier, met with examples. When the patella is broken longitudinally, the cause is always outward violence. (*Œuvres, Chir. de Desault T. 1, p. 252.*)

A transverse fracture of the patella may also originate from a blow, or fall, on the

part; but, in common cases, it is produced by the violent action of the extensor muscles of the leg. It is only of late years, however, that the true mode, in which the bone is usually broken, has been understood. As Boyer observes, for the production of a transverse fracture of the knee-pan, the extensor muscles of the leg need not act with a convulsive force, their ordinary action being strong enough to produce the effect in question, when the body is inclined backward, and the patient is in danger of falling upon his occiput. In this state, the thigh being bent, the extensor muscles of the leg contract powerfully, in order to bring the body forwards, and prevent the fall backwards; and the patella, whose posterior surface then rests only by a point against the forepart of the condyles of the femur, is placed between the resistance of the ligament binding it to the tibia, and the action of the extensor muscles. A fracture now happens the more easily, because, by the flexion of the knee, the line of the extensor muscles, and that of the ligament of the patella, are rendered oblique, with respect to the vertical axis of this bone, which is bent backwards at the point, where it rests upon the condyles. (*Traité des Mal. Chir. T. 3, p. 322. C. Bell's Operative Surgery, Vol. 2, p. 201, 8vo. Lond. 1809. A. Cooper's Surgical Essays, Part 2, p. 86.*) By violent spasmodic action of the extensor muscles, however, the patella may be broken transversely, while the limb is perfectly straight. A very singular case is mentioned by Mr. A. Cooper, where a patella, which had been formerly broken, and united by ligament, was again divided into two portions, in consequence of the destruction of the uniting medium by ulceration. (*Vol. cit. p. 100.*) A case is also on record, where the ligamentous uniting substance was so incorporated with the skin, that when the latter happened to be lacerated, the knee-joint was laid open, and amputation became necessary. (*C. Bell, Op. Surgery, Vol. 2, p. 204.*)

In transverse fractures, there is a considerable separation between the two fragments of the bone, very perceptible to the finger, when the hand is placed on the knee. This separation is not occasioned equally by both portions; the upper one, embraced by the extensor muscles, is drawn upward very forcibly by these powers, which the patella no longer resists; while the inferior portion, being merely connected with the ligament below, is not moved by any muscle, and can only be displaced by the motions of the leg, to which it is attached. Hence, the separation is least when the limb is extended, being then only produced by the upper fragment; greatest, when the limb is bent, because both pieces contribute to it; and it may be increased, or diminished, by bending the knee more or less.

As Boyer has particularly noticed, the laceration, or not, of the tendinous expansion, upon the front of the patella, makes a material difference in these cases, because it is a part of great importance in the cure.

According to this author, a portion of it in simple fractures of the patella generally escapes laceration, and the separation of the fragments is then not very considerable; but violent action of the extensor muscles, the fall subsequent to the fracture, or bending the knee too much, may separate the pieces of bone far from each other, and rupture the tendinous expansion. (*Traité des Mal. Chir. T. 3, p. 328.*) According to Mr. A. Cooper, "when the ligament is but little torn, the separation will be but half an inch; but under great extent of injury, the bone is drawn five inches upwards, the capsular ligament, and tendinous aponeurosis covering it, being then greatly lacerated." (*Surgical Essays, Part 2, p. 84.*)

The upper portion of bone may be moved transversely, and pain is thus excited, but no crepitus can be felt, as the two pieces of bone are not sufficiently near each other. When the swelling of the knee, consequent to fractures of the patella, is very great, the symptoms of the injury may be more or less obscured. However, in consequence of the inability of the extensor muscles to move the leg, except in a few cases where the fracture is very low, the patient cannot stand without difficulty, and is nearly quite unable to walk.

In the treatment of a fractured patella, the chief indications are to overcome the action of the extensor muscles of the leg, and to keep the fragments as near each other as possible, partly by a judicious position of the limb, and partly by mechanical means. The first indication is fulfilled by relaxing the above-mentioned muscles; 1st, by extending the leg; 2dly, by bending the thigh on the pelvis, or, in other words, raising the femur, so that the distance between the knee and anterior superior spinous process of the ilium may be as little as possible, which object, however, will also require the body to be raised, and the pelvis somewhat inclined forwards. In short, as Richter long ago advised, the patient should be almost in a sitting posture, the trunk forming a right angle with the thigh. (*Bibl. Chir. B. 6, p. 611, Gottingen, 1782.*) 3dly, The muscles are to be compressed with a roller. The second indication, or that of placing and maintaining the fragments in contact, or as nearly so as circumstances will allow, is in a great measure already answered by the above recommended position of the limb and trunk; but it is not perfectly fulfilled, unless the upper portion of the bone be also pressed towards the lower fragment, and mechanically held in this situation by the pressure of an apparatus or bandage. And, in pushing the upper fragment towards the lower one, the surgeon should always be careful that the skin be not depressed and pinched between them.

Having described the principles which ought to be observed, I do not know that any great utility would result from a detail of the various methods of treating a broken patella preferred by different surgeons. In the 2d vol. of the First Lines of Surgery

may be found a description of the plan and apparatus employed by Baron Boyer. Desault's practice, which was related in the last edition of this Dictionary, I now omit, as not being exactly such as modern surgeons would adopt; not from any of his principles being erroneous, but because his apparatus is more complicated than necessary.

After putting the patient in bed upon a mattress, and in the desirable posture, with the limb confined, supported, and raised, as above directed, upon a well-padded hollow splint, Mr. A. Cooper applies at first no bandage to the knee, but covers it with linen wet with a lotion composed of liq. plumbi acet. dilut. ℥v. and spir. vin. ℥j. If, on the succeeding day or two, there be much tension, or ecchymosis, leeches should be applied, and the lotion continued; but the employment of a bandage is not to commence until the tension has subsided; for Mr. A. Cooper assures us, that he has seen the greatest suffering, and such swelling as threatened gangrene, produced in these cases by the too early use of a roller. Instead of a circular bandage, placed above and below the broken bone, and drawn together with tape, &c. so as to bring the upper fragment towards the lower one, this experienced surgeon prefers the following method. A leather strap is buckled round the thigh, above the broken and elevated portion of bone, and from this circular piece of leather, another strap passes under the middle of the foot, the leg being extended, and the foot considerably raised. This strap is brought up to each side of the patella, and buckled to the leather band already applied to the lower part of the thigh. It may also be fastened to the foot, or any part of the leg, with tapes. The limb is to be confined in this position five weeks, if the patient be an adult, and six if advanced in years. Then a slight passive motion is to be begun, and to be gently increased, from day to day, until the flexion of the knee is complete. (*Surgical Essays, Part 2, p. 91.*) But, although the impropriety of making any constriction of the knee with a bandage, while the skin is swelled and inflamed, must be obvious, the surgeon ought to be apprised, that such swelling and inflammation ought not to occasion the least delay in placing the limb in the right posture, and pressing the upper fragment towards the lower one. Mohrenheim ascribes the lameness so frequent formerly after this fracture, partly to the custom of not thinking of bringing the pieces of bone together until the swelling had subsided, and partly to the fashion of bending the joint too soon, with a view of preserving its motion. But, says he, nothing can be clearer than that it is most advantageous to attend to the union of the fracture first, and to the flexibility of the joint afterward. (*Beobachtungen, 2 B. 8vo. 1783.*) Boyer has likewise remarked, that the uniting substance is apt to yield, and become lengthened by bending the knee too early, and he therefore never allows this motion

to be performed before the end of two months. When the ligamentous substance is long, and the patient very slow in regaining the use of the extensor muscles, he should sit every day on a table, and endeavour to bring them into action, and as this increases, a weight may be affixed to the foot, as Hunter, Sheldon, &c. recommend.

Nothing keeps the leg more surely extended than a long, broad, excavated splint, with a suitable pad applied to the posterior part of the thigh and leg, and fixed there with a roller, while the thigh itself is to be bent by raising the whole limb, from the heel to the top of the thigh, with pillows, which, of course must form a gradual ascent from the tuberosity of the ischium to the foot.

The broken patella is almost always united by means of a ligamentous substance, instead of bone.

However, that an osseous union may follow a transverse fracture of the patella, and still more frequently a perpendicular one, is a fact of which there is now not the slightest doubt. Thus, Lallement has published an unequivocal specimen of a transverse fracture united by bone, with the history of the case, and the appearances after the death of the patient from some other affection. (*Boyer, Traité des Mal. Chir. T. 3, p. 355, &c.*) In the collection of Dr. William Hunter, there is one well-marked instance of the bony union of a transverse fracture of the patella, and other examples have been seen in the dead subject by Mr. Wilson. (*On the Structure, Physiology, &c. of the Skeleton, p. 240.*) The reason why transverse fractures of the patella, do not commonly unite by callus, is not owing to the want of power in this bone to produce an osseous connecting substance; for, as Larrey has several times noticed, if the fragments are kept in perfect contact by means of a suitable apparatus, their bony reunion becomes so complete, that scarcely any vestige of the injury can afterward be traced. (*Journ. Complém. T. 8, p. 114.*) Indeed, it is a fact on which Larrey dwells, as affording a proof that callus is produced not by the periosteum, but by the vessels of the bones themselves. And what must add strength to the purport of the foregoing remarks is, the consideration that perpendicular or longitudinal fractures of the patella, which are not liable to any displacement from the action of the extensor muscles of the leg, readily admit of bony union. (*Wilson on the Structure and Physiology, &c. of the Skeleton, p. 239.*) This is a statement which, I think, could not be rendered doubtful by any experiments made on animals, without the advantages of quietude and proper treatment. Yet, there are other facts related, which prove that both in longitudinal and transverse fractures a ligamentous union is generally produced, when the fragments are separated; but if these are not drawn asunder, an osseous union takes place. Thus, in one case, reported by Mr. A. Cooper, one-third of the patella was separated from the rest of this bone, and had united by ligament, a free

motion being left between the fragments. (*Surgical Essays, Part 2, p. 94.*) The same gentleman divided the patella longitudinally in a dog, without extending the division into the tendon above, or the ligament below, so that the fragments could not be separated. In three weeks, a close bony union was the result. (*P. 95.*) A case is also related, in which a gentleman fractured the patella transversely, and the lower portion likewise perpendicularly. The transverse fracture united, as usual, by ligament; the perpendicular one, by bone. (*P. 96.*)

The incorrect notions, formerly entertained, respecting the inconveniences of an exudation and projection of the callus into the joint after a fracture of the patella, and especially when the fragments are kept in contact, were long ago refuted by Pott and Sheldon. (*Pott's Chir. Works, Vol. 1, p. 332, Ed. of 1808. Sheldon's Essays on the Fracture of the Patella, &c. 8vo. Lond. 1789.*) On the contrary, as Mr. A. Cooper particularly remarks, "the internal articular surface of the bone preserves its natural smoothness." (*Essays, Part 2. p. 86.*) How such doctrine of a superabundant callus could ever be reconciled with the doubts about a bony union ever being possible, appears difficult of explanation.

Pott, and some others, thought that there being commonly an interspace afterward between the two pieces of the patella, with a certain length of the connecting substance, might be advantageous in the motion of the joint; but Desault, Boyer, Mr. A. Cooper, Sir J. Earle, and others, have always found that the greater the distance between the two pieces of the bone, the greater is the difficulty afterward in walking up a rising, or over an unequal ground.

In the treatment of a longitudinal, or perpendicular, fracture of the patella, the leg should be kept extended, leeches used, and a cold lotion applied. After a few days, a roller is to be put round the limb, and then a laced knee-cap, with straps buckled round the limb above and below the patella. (*A. Cooper, Vol. cit. p. 96.*) The experience of Dupuytren confirms the fact, that a longitudinal fracture of the patella is soon well consolidated. (*Annuaire Med. Chir. de Paris, p. 98, 4to. Paris, 1819.*) Compound fractures of the patella frequently terminate in the death of the patient, unless amputation be done early. The injury, however, does not invariably lead either to the loss of life or limb. I saw a case in St. Bartholomew's hospital last summer (1820,) under Mr. Vincent, where the patella was broken to pieces, and the opening so extensive, that the fingers readily passed into the joint; yet, after a tedious confinement, the formation of abscesses, and the separation of several fragments of bone, the patient recovered with a stiff joint. In general, however, I believe, with Mr. A. Cooper, that in compound fractures of the patella, if the laceration be extensive, or the confusion very considerable, amputation will be required:

but, if the wound be small, the patient not irritable, and no sloughing of the integuments, or ligament, likely to occur, it will be best to try to save the limb. (*Vol. cit. p. 99.*) The wound should be reunited as speedily as possible, and advantage taken of evaporating lotions, perfect rest in a desirable posture, a very low regimen, leeches, venesection, and saline opening medicines. Since writing the above remarks, I have seen another case of bad compound fracture of the patella in St. Bartholomew's hospital, where it has been about a month. No fragments of bone have yet been removed, but a good deal of matter issues daily from the wound. The case must be regarded as in a very precarious state, though if hectic symptoms should not lower the patient too much, the limb will probably be saved.

In addition to the works already cited, consult D. H. Meibomius *de Patellæ Osse, ejusque Læsionibus, et Curatione, Franck. 1697. P. Camper, Diss. de Fracturâ Patellæ, et Olecrani, 4to. Hæge Comit. 1789. Buirer in v. Siebold Chiron. 3, 1, p. 64.*

FRACTURES OF THE LEG

May be transverse or oblique. The first case is alleged to be most common in children. Experience proves, that the two bones of the leg are much more frequently broken together, than singly; a fact ascribed by Boyer to the strength of the knee and ankle joints. (*Traité des Mal. Chir. T. 3. p. 360.*) The direction of an oblique fracture of the tibia is found to be pretty constantly from below upwards, and from within outwards, the end of the upper fragment mostly presenting itself under the skin at the front and inner part of the leg. In these cases, the longitudinal displacement of the fracture is less constant, than the horizontal and angular. However, when it does happen, the inferior fragments are drawn outward and backward, whilst the superior project internally and forward. The angular displacement may be produced either by the action of the posterior muscles of the leg, or the weight of the body, and, in both cases, the angle projects forwards. But it may be directed posteriorly, if the heel be too much raised. A rotatory displacement, most commonly happening in the direction outwards, is produced by the inclination of the foot, and if this be turned too much inwards the rotatory displacement will be in that direction. A longitudinal displacement cannot take place in transverse fractures, on account of the considerable extent of the surfaces of bone; but, in oblique fractures, the inferior fragments are almost always drawn upward by the action of the posterior muscles of the leg, in which position of the parts, the lower ends of the superior fragments project forwards, and may be felt by the hand. Sometimes, however, when the solution of continuity is obliquely downward and outward, the anterior projection will be produced by the lower pieces. In both kinds of displacement, the pointed ends of

the bones may tear and penetrate the integuments, and cause a compound fracture.

The usual symptoms, denoting a fracture of both bones of the leg, are a change in the direction and shape of the limb, pain, and incapability of walking or bearing upon the limb, mobility of the fractured pieces, and a distinct crepitus.

Fractures near the knee are not very subject to displacement, on account of the thickness of the tibia at that part; but they are more dangerous than those of the middle of the bone, because often followed by ankylosis of the knee-joint. Fractures, close to the ankle, are still more dangerous. Oblique fractures are very difficult of management, and when their displacement is upward and outward, the integuments are in danger of being torn by the projecting points of the superior portion of the tibia. (Boyer.) To bad compound fractures of the leg most of the observations are applicable, already delivered on compound fractures in general.

When the size of the tibia is compared with that of the fibula, and the close connexion of these bones to each other is remembered, an opinion might be formed, that the first could never be broken without the second. Experience, however, proves the contrary. And reasons for this fact, as Boyer remarks, may be deduced from the consideration, that the tibia is the bone which supports the weight of the body, and that it is situated at the forepart of the limb, simply covered by the skin, and much exposed to the effects of violence. (*Traité des Mal. Chir. T. 3, p. 373.*) When the tibia alone is broken, the fracture is said to be generally transverse.

If the injury happens near the knee, the great extent of the fractured surfaces prevents any considerable displacement of the fragments; and the fibula acting as a support on the external side, contributes also to this effect. Boyer, however, has seen one instance, in which the tibia was broken by the kick of a horse, and the fragments displaced in the direction of the axis of the bone, which displacement could not be rectified, so that the bone remained permanently arched at the part.

The absence of displacement often renders the diagnosis of fractures of the tibia very difficult, and the difficulty is further increased by the little pain and inconvenience produced by such a fracture, with which persons have been known to walk.

Whenever there is reason to suspect the accident, in consequence of a blow or a fall on the leg, the part should be minutely examined. The fingers are to be moved along the anterior side of the tibia, the slightest inequality in which may be easily perceived, on account of its being covered only by the skin; and the motion of the pieces may be perceived, by grasping the opposite ends of the bone, and pushing them in contrary directions. However, this motion, and the crepitus, are very indistinct, on account of the fibula not allowing the fractured por-

tions to be sufficiently moved on one another.

In a review of the position and strength of the two bones of the leg, it will appear that the tibia supports alone the whole weight of the body, every shock directed in the axis of the limb, and many kinds of force applied also in the transverse direction, without operating upon any particular point. Hence, the frequency of fractures of the tibia; and if the fibula is generally broken at the same time, the latter injury is but subsequent to the other, and takes place because this slender bone is not capable of bearing the weight of the body, the impulse of external violence, and even the action of the muscles, after the tibia has given away. (*Dupuytren Annuaire Med. Chir. des Hospitaux de Paris, p. 15. 4to. Paris, 1819.*) On the other hand, as the same distinguished surgeon remarks, the fibula being principally designed as a support for the outside of the foot, it is particularly when this function is to be executed, and its lower end has to make resistance to efforts made in that direction, that it is fractured; and if the lower part of the tibia is also sometimes broken by the same force, it is almost always consecutively, and not by the effect of a direct and simultaneous action upon the two bones. (P. 17.) All fractures of the fibula, however, are not caused in the preceding manner; and Dupuytren concurs with Boyer, Mr. C. Bell, and all the best writers on this subject, in dividing these cases into two kinds; first, those in which the force is applied directly to the bone itself; secondly, the more important and serious cases, in which the force operates upon the fibula, through the medium of the foot. With respect to the first class of cases, the situation of the fibula on the outer side of the leg, a situation which would seem to expose it much to external violence; its slenderness; the interspace left between it and the tibia at the middle part of the leg; and the way in which each end of it rests upon the latter bone; would lead one to expect that its middle portion must often be broken; yet the case is less frequent than might be apprehended. And, as Dupuytren observes, there are two reasons for this fact; viz. the protection which the fibula receives from the peronæi muscles, and the rarity of circumstances capable of producing a fracture by a direct cause. These fractures, which are usually attended with deformity, and in some cases, even do not hinder the patient from bearing upon the foot, cannot for the most part be ascertained, unless attention be paid to the manner in which the accident was produced, and to the presence of ecchymosis, and of more or less pain in the part which has been struck, or pressed upon; together with a degree of irregularity of the fibula, perceptible by the fingers, and a more or less distinct moveableness and crepitus of the ends of the fracture.

The usual causes of this sort of fracture are blows on the fibula, gunshot wounds, the fall of heavy bodies on the outside of the

leg, or the passage of them over the same part. The foot is generally twisted, neither inwards nor outwards, and in most instances, the accident is easily cured by means of rest, without being accompanied by any of the symptoms so often complicating other fractures of the fibula, produced by distortion of the foot. (*Dupuytren, Vol. cit. p. 40.*) A striking analogy may be remarked between fractures of the central part of the fibula and those of the corresponding portion of the ulna, and this in respect to causes, symptoms, treatment, and consequences. Fractures of the middle of the ulna, like those of the body of the fibula, are always occasioned by blows or falls on the fractured part, or by violence applied directly to the bone. Such fractures are scarcely ever attended with any deformity in the limb, incapacity of moving it, or displacement of the fragments; and just as some individuals are able to walk with a broken fibula, others, notwithstanding a fracture of the ulna, are found capable of using their fore-arm nearly as well as if it were free from injury. The latter case, like that of a fracture of the fibula, can only be known by the recollection of the way in which the hurt was received, the pain, ecchymosis, irregularities, motion, and crepitus, which last effects are also not very obvious so high up the bone. Like fractures of the body of the fibula, those of the body of the ulna only require rest and discutient applications, and very seldom the bandages, &c. necessary in the treatment of fractures of both bones of the fore-arm, or those of the radius alone. (*Vol. cit. p. 50.*)

Fractures of the fibula from an *indirect* cause may happen from the foot being violently twisted, either inwards or outwards. In both instances, the cause of the fracture is a change in the direction of the line, in which the weight of the body is transmitted. In the first case, the said line, instead of following, as it commonly does, the axis of the tibia, and falling upon the astragalus, crosses the lower end of the tibia, and the ankle joint, obliquely from within outwards, and after passing across the malleolus externus, extends to the outside of the member. The parts then supporting the weight of the body are the malleolus externus, and the lower end of the tibia, besides which state of parts, the same malleolus is subjected to the traction of the external lateral ligaments, which operate with great force in consequence of those ligaments being now nearly as a right angle with the lower end of the fibula, while this process itself is in contact with the astragalus, which is propelled from within outwards by the tibia. The latter bone, being thicker and stronger than the fibula, generally resists, and if the malleolus internus sometimes happens to break, it is secondarily, as an effect of the displacement of the foot outwards.

In the other example, where the foot is twisted outwards, the centre of gravity of the body, instead of following its usual course, obliquely crosses the lower end of the fibula, the ankle-joint, and the malleolus

internus, and falls on the ground at a greater or lesser distance from the inner edge of the foot. On the one side, the internal lateral ligaments and malleolus, and on the other, the lower end of the fibula, are then the parts which have to bear the weight of the whole body, and the force of the muscles; and they are also the parts which are torn and fractured; first, the internal lateral ligaments, or the malleolus; and secondly, the lower portion of the fibula. (*Annuaire, Méd. Chir. de Paris, 1819, p. 66. 67.*) Some of the symptoms of a fracture of the fibula, from an *indirect* cause, depend upon the fracture of that bone, and others upon the dislocation of the foot. They are divided by Dupuytren into two kinds; viz. *presumptive*, and *characteristic*. The first are, the way in which the patient received his hurt; a noise, or sort of crack heard by him at the instant of the injury; a fixed pain at the lower part of the fibula; a difficulty, or inability of walking; more or less swelling round the ankle, especially about the malleolus externus, and lower portion of the fibula. The *characteristic symptoms* are, an irregularity and unnatural moveableness of some point of the lower end of the fibula; a crepitus, which can be more or less distinctly felt by pressing upon and moving the part; mobility of the whole foot transversely, or horizontally; a facility of bringing the lower end of the fibula towards the tibia by pressure; a change in the point of incidence of the axis of the limb upon the foot; distortion of the foot outwards, and sometimes backwards; rotation of the same part upon its axis from within outwards; an angular depression, more or less manifest at the outer and lower part of the leg; projection of the internal malleolus; disappearance of almost all these symptoms, as soon as reduction is effected by a force applied to the foot; and their immediate recurrence when such force is discontinued, particularly if the limb be in the extended posture. (*Vol. cit. p. 68.*)

In considering the varieties of simple fracture of the fibula, the first to which Dupuytren adverts, is that in which the bone is broken *more than three inches above the extremity of the malleolus externus*; a case, neither accompanied nor followed by any displacement of the foot, and almost always produced by the direct application of violence to the broken part of the bone.

A second variety of simple fractures of the fibula is when the bone has been broken, either by direct or indirect force, within three inches from the end of the malleolus externus, and when the foot is not displaced, though much displacement is possible, and, indeed, often arises from the slightest effort, or movement made by the patient. The most frequent point of injury is about two inches and a half above the extremity of the outer malleolus. This is generally the place of a fracture, caused by a twist of the foot outwards; but, the accident may happen lower down, as is commonly seen, when the

fracture is occasioned by a twist of the foot inwards.

These fractures of the fibula, abstractedly viewed, are not of much importance in themselves; but, with reference to the manner in which they facilitate the dislocation of the foot, they are very serious.

Among the most frequent complications of fractures of the fibula, are the rupture of the internal lateral ligaments, the detachment of the point of the inner malleolus, and fracture of the lower part of the tibia. When these injuries originate from a violent twist of the foot outwards, they precede the fracture of the fibula; but, when they are caused by a twist inwards, they follow the breaking of that bone. (*Dupuytren, Vol. vii. p. 96.*)

Besides distortion of the foot outwards, or inwards, as attending certain fractures of the fibula, another complication may be dislocation of the foot backwards, produced by the action of the muscles of the calf, and not by the same causes which broke the bone. However, whenever the malleolus internus has not given way, the dislocation is incomplete, and the foot is inclined outwards as well as backwards. In the complete luxation, as Dupuytren remarks, the bent posture is found exceedingly advantageous, though he admits, that it will not always answer for maintaining the reduction.

TREATMENT OF FRACTURES OF THE LEG.

As in cases of fractured thighs, the practitioner may adopt either a bent or a straight position of the limb; in this country, surgeons mostly follow Mr. Pott's advice, and select the first one, of which alone I shall treat. That the bent position is, generally speaking, the most advantageous for a broken leg, I am well convinced. The strong muscles of the calf of the leg are the powers, which tend to displace the ends of the fracture, and their relaxation is a thing of the first-rate importance. It is quite different in the thigh, where the muscles are so numerous, that the attempt to relax by any position of the limb, all such as have the power of displacing the fragments would be in vain. I am ready to acknowledge, however, that in the bent posture, the apparatus is defective, inasmuch as it does not keep the knee-joint from moving; but yet it is certain that such motion has not so injurious an effect upon fractures of the leg, as it has upon those of the thigh. When the case is complicated with a wound, which cannot be dressed in the bent posture of the limb, without great disturbance of the fracture, the straight position ought unquestionably to be preferred. With respect to one of Mr. Pott's objections to this position, viz. that it makes the knee stiff for a long while afterward, I suspect, that we should not lay much stress upon the circumstance, because, as Boyer has correctly observed, it is always the joint situated below the fracture, that is thus affected.

"In the fracture of the fibula only, (says Pott) the position is not of so much consequence; because by the tibia remaining entire, the figure of the leg is preserved, and extension quite unnecessary; but still, even here, the laying the leg on its side, instead of on the calf, is attended with one very good consequence, viz. that the confinement of the knee, in a moderately bent position, does not render it so incapable of flexion and use afterward, as the straight or extended position of it does, and consequently, that the patient will be much sooner able to walk, whose leg has been kept in the former posture, than he whose leg has been confined in the latter.

"In the fracture of both tibia and fibula, the knee should be moderately bent, the thigh, body, and leg, being in the same position as in the broken thigh. If common splints be used, one should be placed underneath the leg, extending from above the knee to below the ankle, the foot being properly supported by pillows, bolsters, &c. and another splint of the same length should be placed on the upper side, comprehending both joints in the same manner; which disposition of splints ought always to be observed, as to their length, if the leg be laid extended in the common way, only changing the nominal position of them, as the posture of the leg is changed, and calling what is interior in one case, exterior in the other; and what is superior in one, in the other inferior.

"If Mr. Sharp's splints be made use of, there is in one of them a provision for the more easy support of the foot and ankle, by an excavation in, and a prolongation of the lower or fibular splint, for the purpose of keeping the foot steady." (*Pott.*)

The strong muscles of the leg being relaxed by placing the limb in the bent position, as advised by Pott, the surgeon is to make such extension as seems requisite, for bringing the ends of the fracture into even apposition. Then he is carefully to raise the leg a little way from the surface of the bed, by taking firmly hold of the limb, above and below the fracture, and elevating the broken bones together, in such a way as shall keep both the upper and lower portions as nearly as possible on the same level. At this moment, an assistant should put, exactly beneath the leg, the under splint, which has been previously made ready by covering it with a soft pad, and laying over this an eighteen-tailed bandage. The limb is now to be gently depressed, till it rests on the apparatus. The surgeon, before proceeding further, must once more observe, that the ends of the bones are evenly in contact. Being assured of this important point, he is to apply a piece of soap plaster, and lay down the tails of the bandage. Another soft pad, well filled with tow, is next to be put over the upper surface of the leg, and over that the other splint, when the straps are to be tightened.

Mr. Pott's method of treating fractures of the fibula, complicated with luxation of the

tibia, is described in the article *Dislocation*, and Dupuytren's practice in the 2d vol. of the *First Lines of the Practice of Surgery*.

In an oblique fracture of the head of the tibia, extending into the knee joint, Mr. A. Cooper recommends the straight position, in which the femur has the good effect of keeping the articular surfaces of the tibia even. A roller is to be used for pressing one fragment towards the other; a paste-board splint is also to be applied with the same view; and early passive motion of the joint is to be practised in order to prevent ankylosis.

When the fracture is oblique, but does not reach into the joint, the same author prefers placing the limb on the double-inclined plane. (*Surgical Essays, Part 1, p. 103.*)

FRACTURES OF THE SCAPULA.

As Boyer correctly observes, fractures of the scapula are not very common, a circumstance explicable by the deep and covered position of the greater part of this bone, and its great mobility. Nor can these accidents arise without considerable direct violence. However, there are some parts of the scapula, which being more superficial, and of a form more likely to be acted upon by external bodies, are more frequently fractured; such are the acromion, and inferior angle of the bone. Fractures of the coracoid process, and even of the neck of the scapula, are also mentioned; but, the instances of such accidents are not common; and though these parts of the bone may appear in the skeleton likely to be often broken, their deep situation in the living subject generally saves them. Indeed, as Boyer says, they generally require great violence to break them, and then the contusion of the soft parts is a worse injury than the fracture itself: thus, this author has seen the coracoid process broken by the blow of the pole of a carriage, and the patient lost his life from the violence at the same time inflicted upon all the soft parts about the shoulder (*Traité des Mal. Chir. T. 3, p. 161.*)

When the acromion is broken, the weight of the arm, and the contraction of the deltoid muscle, draw it downward, while the trapezius and levator scapulæ draw the rest of the bone upward and backward. When the lower angle is broken, the serratus major anticus draws it forward, while the rest of the scapula remains in its natural situation; or, if the angular portion be considerable, the teres major, and some fibres of the latissimus dorsi, contribute to its displacement forward and upward.

When the coracoid process is fractured, the pectoralis minor, coraco-brachialis, and short head of the biceps, concur in drawing it forward and downward.

When the neck of the scapula is fractured, the weight of the arm makes it drop down so considerably, as to give the appearance of a dislocation; but, the facility of lifting

the os brachii upward, the crepitus, and the falling of the limb downward again, immediately it is unsupported, are circumstances clearly marking, that the case is not a dislocation. Sometimes great pains, and a crepitus, are experienced, on moving the shoulder joint, after an accident; and yet the spine, the neck of the scapula, and all the above parts are not broken. In this circumstance, it is to be suspected, either that a small portion of the head of the os brachii, or a little piece of the glenoid cavity of the scapula, is broken off; which latter occurrence, I think, is not very uncommon.

Fractures of the acromion are attended with pain, which is increased by the motion of the arm; the form of the shoulder is changed; and the broken part which has descended, may be raised, by bringing up the elbow close to the side.

When the inferior angle is broken, the part remains motionless, while the rest of the scapula is moved; and it is so separated, that no mistake can be made. (*Boyer.*)

Fractures of the spine and body of the bone, are all attended with a crepitus; and, in the first cases, an irregularity of the injured part may generally be felt.

The prognosis of fractures of the scapula varies according to the situation of the injury, and the attendant circumstances. Fractures of the body of the bone, whatever may be their direction, are generally very simple, and readily cured. Those of the acromion and lower angle are more troublesome to keep right; but the most serious cases are fractures of the coracoid process and neck of the bone, which cannot be kept right without great difficulty, and are said to be frequently followed by a considerable stiffness of the arm, inability to raise it, its atrophy, and even paralysis. In other respects, the danger of fractures of the scapula depends less upon the solution of continuity in the bone, than the contusion of the soft parts, or injury of the thoracic viscera. However, when the fracture is comminuted, and the splinters are forced in to the subscapularis muscle, abscesses may form under the bone, and, according to Boyer, require a perforation to be made in it; (*Mal. Chir. T. 3, p. 165.*) a proceeding, which I cannot bring myself to think would ever be judicious, as making a depending opening in the soft parts must be far better practice. In military surgery, the scapula is often injured by sabre-cuts; but, as Dr. Hennen remarks, this bone, when preserved from motion, is found in these cases to unite with great readiness, and without future inconvenience. (*Principles of Military Surgery, p. 48, Ed. 2.*)

According to Boyer, when the scapula is fractured longitudinally, or transversely, it is merely necessary to fix the arm to the side by means of a bandage, which includes the arm and trunk, from the shoulder to the elbow. Thus, the motions of the shoulder, which are only concomitant with those of the arm, are prevented.

When the inferior angle is broken, and

Drawn downward and forward by the serratus major anticus, the scapula must be pushed toward the fragment, by pushing the arm itself inward, downward, and forward, where it is to be kept with a roller. The fragment is also to be kept backward, as much as possible, with compresses and a roller, and the arm is to be supported in a sling.

The fractured acromion requires the arm to be so raised, that the head of the os brachii will push up the acromion, while an assistant pushes the scapula forward and downward, in a contrary direction to that of the arm. To maintain this position, a circular bandage is to be applied round the arm and body.

Desault used to apply also a small pillow under the axilla, before putting on the bandage, in order to make the head of the os brachii project more upward, on bringing the arm near the side. Compresses are to be placed on the scapula, which, by this means, and a roller, is to be kept downward and forward.

When the coracoid process is fractured, the muscles attached to it are to be relaxed, by bringing the arm forwards towards the breast, and confining it there in a sling; while the shoulder is kept downward and forward, and a compress confined just under the broken part with a roller.

The treatment of a fracture of the neck of the scapula consists in raising the shoulder to its proper height; in completely taking off the weight of the arm, by means of a proper sling, which always supports the limb from the elbow to the fingers; and in entirely preventing all motion of the arm by binding it to the trunk with a roller.

FRACTURES OF THE CLAVICLE.

This bone being long and slender, unsupported at its middle, and protected externally only by the integuments, is very often broken. Its serving to keep the scapula at a proper distance from the sternum, and as a *point d'appui* for the os brachii, every impulse of which it receives, makes its fractures still more common.

It may be broken at any part; but its middle, where the curvature is greatest, is most frequently the situation of the injury. It is not very often fractured at its scapulary extremity. However, a direct force, falling on the shoulder, may break any part of the clavicle, on which it immediately acts. The soft parts, in this kind of case, will also be contused, or even lacerated.

A comminuted fracture may be thus occasioned, and if the violence be very great, the subclavian vessels and nerves may be torn. The fall of a heavy body on the shoulder often gives rise to a paralysis of the arm.

When the fracturing force is applied to the ends of the bone, as by a fall on the point of the shoulder, or on the hands, while the arms are extended, the clavicle may be very much bent, and fractured so obliquely,

that the broken portions protrude through the skin.

Fractures of this bone are usually attended with displacement of the broken ends, except when the injury takes place at the scapulary extremity, and within the ligament, tying together the clavicle and coracoid process.

The external portion of the clavicle is always that which is displaced. The internal part cannot be moved out of its natural situation, by reason of the costo-clavicular ligaments, and of its being drawn in opposite directions, by the sternocleido-mastoideus, and pectoralis major, muscles. The external portion, drawn down both by the weight of the arm, and the action of the deltoid muscle, and forward and inward by the pectoralis major, is carried under the internal portion which projects over it. The broken clavicle no longer keeping the shoulder at a due distance from the sternum, the arm falls forward towards the breast. The patient finds it impossible to put his hand to his forehead, because this act makes a semicircular motion of the humerus necessary, which cannot be done while that bone has not a firm *point d'appui*. The shoulder and upper extremity may be observed to be nearer the breast, than those of the opposite side. The motion of the pieces of bone on one another may be felt, as well as the projection of the end of the internal portion. When the shoulder is moved, a crepitus may also be perceived; but this is productive of great pain, and the diagnosis is so obvious, that it is quite unnecessary.

The ancients, and many moderns, have supposed, that, in order to set a fracture of the clavicle, the shoulder must be drawn back, and fixed in that position. The patient was placed on a low stool, so that an assistant might put his knee between the shoulders, which he drew back at the same time with both hands, while the surgeon applied the bandage, which was to keep the parts in this position. But when the shoulders are thus drawn towards one another, the scapula is obviously pushed towards the sternum, and with it the external portion of the clavicle, which passes under the internal fragment.

The figure of 8 bandage has commonly been used for maintaining the parts in this position. While the assistant keeps back the shoulders, as above described, the surgeon is to apply one end of a roller to the arm-pit on the side affected, and then make it cross obliquely to the opposite shoulder, round which it is to pass, and from this to the other shoulder, about which it is to be applied in the same manner, and afterward repeatedly crossed before and behind. The tightness, with which it is necessary to apply this bandage, produces a great deal of excoriation about the arm-pits, and the effect is to make the ends of the fracture overlap each other, the very thing which it is wished to avoid. Boyer remarks, that the iron cross proposed by Heister, the corslet described by Brasdor in the *Mem. de l'Acad.*

de Chir. and the leather strap recommended by Brunninghausen, are only modifications of the figure of 8 bandage, and are not at all better.

Desault advised extension to be made, by means of the limb, which is articulated with the fractured bone. This is done by converting the humerus into a lever, by carrying its lower end forward, inward, and upward, pushing the shoulder backward, upward, and outward, and putting a cushion in the arm-pit to serve as a fulcrum.

Desault used to put in the arm-pit a hair or flock cushion, five or six inches long, and three inches and a quarter thick at its base. Two strings are attached to the corners of the base placed upward, which cross the back and breast, and are tied to the shoulder of the other arm. The cushion being thus placed in the arm-pit, and the fore-arm bent, Desault used to take hold of the patient's elbow, and carry it forward, upward, and inward, pressing it forcibly against the breast. By this manœuvre, the humerus carries the shoulder outward, the ends of the fracture become situated opposite each other, and all deformity is removed.

An assistant is to support the arm in this position, while the surgeon, having a single-headed roller nine yards long, is to place one end of it in the arm-pit of the opposite side, and thence apply the bandage over the upper part of the arm, and across the back to the same situation. The arm and trunk are to be covered with such circles of the roller, as far down as the elbow, drawing the bandage more tightly, the lower it descends.

Compresses, dipped in camphorated spirit, are next to be placed along the fractured bone. Desault then took a second roller, of the same length as the first, and put one end of it under the opposite arm-pit, whence it was carried across the breast over the compress and fracture, then down behind the shoulder and arm, and, after having passed under the elbow, upward on the breast. Desault next brought it across to the sound shoulder, under and round which he passed it, for the purpose of fixing the first turn. He then conveyed the roller across the back, brought it over the compresses, carried it down in front of the shoulder and arm, under the elbow, and obliquely behind the back to the arm-pit, where the application began. The same plan was repeated, until all the roller was spent. The apparatus was secured by pins, wherever they promised to be useful, and the patient's hand was kept in a sling.

Boyer has invented an apparatus for fractured clavicles, which is more simple than that employed by Desault.

The cushion is to be applied under the arm. The apparatus consists of a girdle of linen cloth, which passes round the trunk on a level with the elbow. It is fixed on by means of three straps, and as many buckles. At an equal distance from its extremities are placed externally on each side two buckles, two before and two behind the arm. On the lower part of the arm, is to be laced a piece

of quilted cloth, five or six fingers broad. Four straps are attached to it, which correspond to the buckles on the outside of the girdle, and serve both to keep the arm close to the trunk, and from moving either backward or forward.

Certainly, the methods recommended by Desault and Boyer are very judicious and scientific. They are not, however, much adopted in this country, perhaps in consequence of the general aversion among English surgeons to every apparatus which is not exceedingly simple. It is to be hoped, at the same time, that, in the treatment of fractured clavicles, they will always attend to the principles which Desault and Boyer have inculcated. If they understand why the position of the arm should be such as these eminent surgeons point out, they will have no difficulty in doing what is proper, and with a cushion, sling, and a couple of rollers, they will easily maintain the proper posture.

I cannot quit this subject without cautioning surgeons never to fall into the error of supposing the rising end of a broken clavicle to be the end which is displaced. This is the one which is truly in its right situation, and which has often been made by injudicious pressure to protrude through the integuments, as I myself have seen.

FRACTURES OF THE OS BRACHII, OR HUMERUS.

This bone may be fractured at any point of its length: at its middle, either of its extremities, or above the insertion of the pectoralis major, latissimus dorsi, and teres major. The last case is termed fracture of the neck of the humerus; but that denomination has not the merit of being strictly anatomical. It is possible, however, that what is strictly called the neck of the humerus may be fractured, particularly by a gunshot wound. By neck of the humerus, we understand that circular narrowing, which separates the tuberosities from the head.

The fractures of this bone may be transverse or oblique, simple or compound. Transverse fractures of its middle part, below the insertion of the deltoid muscle, are attended with but little displacement; for the brachialis internus and the triceps, being attached posteriorly and anteriorly to both fragments, counteract one another, and admit only a slight angular displacement. When the fracture takes place above the insertion of the deltoid muscle, the inferior portion is first drawn outward and then upward on the external side of the superior. Fractures of the humerus, near its lower end, such particularly as are transverse, are not subject to much displacement: a circumstance to be attributed to the breadth of the fractured surfaces; to their being covered posteriorly by the triceps muscle, and anteriorly, by the brachialis internus, which admit only a slight angular displacement, by the inferior portion being drawn a little forward.

Oblique fractures are always attended with displacement, whatever be the part of the

bone broken. The inferior portion being drawn upward by the action of the deltoides, biceps, coraco-brachialis, and long portion of the triceps, glides easily on the superior, and passes above its lower extremity. Finally, fractures of the neck of the humerus are always attended with displacement, produced by the action of the pectoralis major, latissimus dorsi, and teres major, which being attached to the lower portion near its superior extremity, draw it first inward and then upward, in which last direction it is powerfully urged by the biceps, coraco-brachialis, and long portion of the triceps. In this case, the superior portion itself is directed a little outward by the action of the infraspinatus, supraspinatus, and teres minor, which make the head of the humerus perform a rotatory motion in the glenoid cavity.

The shortening and change in the direction of the limb, the crepitus, which may be very distinctly perceived by moving the broken pieces in opposite directions, the pain, and impossibility of moving the arm, &c. joined to the history of the case, render the diagnosis sufficiently plain.

Fractures of the neck of the humerus, however, are not so easily ascertained, and for want of attention, have been frequently confounded with luxations of that bone. Yet, the diagnostic symptoms of these two affections are very different.

When the neck of the humerus is fractured, a depression is observed at the upper part and external side of the arm, very different from what accompanies the luxation of that bone downward and inward. In the latter case, a deep depression is found, just below the projection of the acromion, in the natural situation of the head of the humerus; whereas, in fracture of the neck of that bone, the shoulder retains its natural form, the acromion does not project, and the depression is found below the point of the shoulder. Besides, on examining the arm-pit, instead of finding there a round tumour, formed by the head of the humerus, the fractured and unequal extremity of that bone will be easily distinguished. The motion of the broken portions, and the crepitus, thus produced, serve still further to establish the diagnosis. (*Boyer.*)

In a simple fracture of the body of the humerus, the prognosis is generally favourable; but fractures near the elbow are liable to be followed by more or less stiffness of the joint, often very difficult of removal.

In ordinary fractures of the os brachii, it is usual to apply two pieces of soap-plaster, which together surround the limb, at the situation where the accident has happened. Extension, if necessary, being now made by an assistant, who at once draws the lower portion of the bone downward and bends the elbow, the surgeon is to apply a roller round the limb. The external splint is to extend from the acromion to the outer condyle, and being lined with a soft pad, the wood cannot hurt the limb by pressure. The internal splint is to reach from the margins of the axilla to a little below the inner

condyle, and is to be well guarded with a pad, filled with tow, or any other soft materials.

Some surgeons are content with the application of two splints; but though the two, above described, are those on which we are to place the greatest reliance, yet, as the cylindrical form of the arm conveniently allows us completely to incase this part of the limb in splints, I consider the employment of four better; one on the outside, one in the inside, one on the front, and another on the back of the arm. These are to be carefully fixed in their respective situations by means of tape.

Throughout the treatment, the elbow and whole of the fore-arm are to be quietly and effectually supported in a sling.

FRACTURE OF THE HEAD, OR NECK OF THE OS BRACHII.

Chirurgical language here differs from that adopted by anatomists, and under the name of fracture of the neck of the humerus, is not meant, that of the circular, hardly perceptible depression, which separates the head from the tuberosities of this bone. By this expression, surgeons imply the fracture of that contracted part of the humerus, which is bounded above by these tuberosities; which below is continuous with the body of the bone; which has the tendons of the pectoralis major, latissimus dorsi, and teres major inserted below it; and which many practitioners extend even as low as the insertion of the deltoid muscle.

Indisputable facts, however, prove the possibility of the anatomical neck of the bone being fractured and C. Larbaud showed Bichat the humerus of a young man, aged 17, the head of which bone was accurately detached from its body, by a division which had obliquely interested the upper part of the tuberosities. An instance of this kind, I think, was pointed out to me this spring (1821) in St. Bartholomew's hospital. The patient was a boy, whose elbow had been strongly kept up, on the supposition, that the case was a fracture of the neck of the scapula, and consequently, the irregular end of the humerus formed a remarkable projection in front of the acromion, yet capable of being pushed back, where, however, it would not remain. When the accident is produced by a direct blow or fall on the fleshy part of the shoulder, the deltoid is sometimes contused and affected with ecchymosis. Even blood may be effused from some of the ruptured articular veins, or arteries, and form a collection, which Desault recommended to be speedily opened, though the reason of such practice, as a general thing, must be questionable, because large extravasations of blood about the shoulder are usually very soon absorbed.

The counter-fracture arises from a fall on the elbow, when this part is separated from the trunk, or else from a fall on the hand, which a natural instinct makes us ex-

tend, with the arm and fore-arm, to protect ourselves at the time of falling.

The whole of the symptoms of a fracture of the neck of the humerus sufficiently denote its existence; but it is not always an easy matter to see this whole, and here more difficulties occur in the diagnosis than in any other fracture of the humerus.

An acute pain is experienced at the moment of the fall; sometimes the noise of something breaking is heard. There is always a sudden inability to move the limb, which, left to itself, remains motionless. But, on external force being applied to the member, this readily yields, and admits of being moved with the greatest ease, in every direction.

An acute pain attends such motion, which, carried too far, may cause bad consequences, as has been observed in patients in whom the fracture has been mistaken for a dislocation.

Below the acromion a depression is remarkable, always situated lower down than that which attends a dislocation. If we place one hand on the head, while the lower part of the bone is moved in various directions with the other hand; or, if while extension is made, an assistant communicates to the bone a rotatory motion, the following circumstances are perceived. 1. The head of the humerus remains motionless. 2. A more or less distinct crepitus is felt, arising from the two ends of the fracture rubbing against each other. These two symptoms are characteristic of the accident; but the swelling of the joint may prevent us from detecting them.

Sometimes there is no displacement of the ends of the fracture, and then, as most of the symptoms are absent, the diagnosis is still more difficult. In general, however, the ends of the fracture are displaced, and in this circumstance, it is the lower one, which is out of its proper position, and not the upper one, which is of little extent, and is not acted upon by many muscles.

The displacement is generally not very perceptible, in regard to length, unless the fracture be very oblique, and its pointed spiculæ irritate the muscles, and make them contract with increased power; or unless the blow, which was very violent, continued to operate after the bone had been broken, and forced the ends of the fracture from their state of apposition. In this way, the body of the humerus has been drawn or driven upward, so as to protrude through the deltoid muscle, and integuments, far above the height of the head of the bone.

But commonly, as Petit observes, the weight of the limb powerfully resists the action of the muscles, and the displacement of the fracture is more liable to be transverse. In this circumstance, the lower end of the fracture is displaced outward or inward, and rarely in any other direction. In the most frequent case, the elbow is separated from the trunk, and cannot be brought near it without pain; and in the instance of

the bone being displaced outward, the limb has a tendency to the opposite direction.

A fracture of the neck of the humerus is not a serious event, and if, as Heister remarks, *prope caput, fractura pejor, et difficilior curatur*, it is less on account of the nature and situation of the disease, than of the difficulty experienced in maintaining the ends of the fracture in contact.

The reduction usually presents but few difficulties, and the multiplicity of means formerly employed for its accomplishment, serve only to exhibit the uselessness of such resources.

Most of the machines, designed for reducing dislocations of the humerus, were applied to this kind of fracture. To such machines succeeded the use of pulleys, weights suspended to the limb, &c. useless plans, as their only tendency was to increase the natural power, which was always more than sufficient.

Petit proposes to reduce the fracture, by first placing the arm at a right angle with the body; and then making extension with the hands of an assistant, applied above the elbow; while the counter-extension is made by another assistant, who is to take hold of the fleshy part of the shoulder. This method is liable to three inconveniences. It fatigues and even pains the patient; it lessens the extending powers by bringing them near the moveable point; and it irritates such muscles as proceed from above to the lower end of the fracture, and thus increases their disposition to contract. Hence, difficulties sometimes attended the reduction, which is always simple, when the trunk being fixed, gentle extension is made on the fore-arm half bent. Desault used to accomplish the reduction in the following way.

The patient may either sit upon a chair, or the edge of a bed. The arm is to be a little separated from the trunk, and carried somewhat forward.

An assistant is to fix the trunk by drawing towards him the arm of the opposite side. This mode of making extension is preferable to that commonly employed, and which is effected by applying the hands to the upper part of the affected shoulder. The other being more distant from the resistance, there is no need for exerting so much power; and the patient's body being quite uncovered, the surgeon can conveniently apply the bandage, without disturbing the extension.

A second assistant extends the fore-arm half bent, which he makes use of as a lever, placing one hand behind the wrist for the purpose of a fulcrum. The other hand, applied to the front and middle part of the fore-arm, and making pressure upon it from above downward, represents the power. The ends of the fracture, which are to be placed in apposition, form the resistance.

The relaxation of muscles, produced by the half flexion of the fore-arm, and the position of the arm a little raised from the side, are peculiarly favourable to this mode of extension, recommended by the ancients and English. This method has also the ad-

vantage of leaving uncovered every part of the limb, to which the apparatus is to be applied.

The reduction takes place of itself, on employing a very little force, methodically directed, according as the fracture is displaced inward or outward. If the surgeon put his hands on the situation of the fracture, it is rather to examine the state of the ends of the broken bone, than to accomplish a thing seldom required, namely, what is implied by the term coaptation.

Every apparatus for the cure of fractures being only resistances, made by art to the powers causing the displacement of the broken part, it follows, that the whole should act in an inverse ratio to such powers. We have seen, that these consisted; 1. Of the action of external bodies, favoured by the extreme mobility of the arm and shoulder; 2. Of the action of the latissimus dorsi, pectoralis major, and teres major, which draw inward the lower end of the fracture, or, what is more common, of the deltoid, which pulls it outward; 3. Of the contractions of the muscles of the arm, which tend to draw the end of the fracture a little upwards.

Hence, 1. to render the arm and shoulder immoveable; 2. to bring either outward, or inward, the lower end of the fracture; 3. to draw downward the same; are the three indications, which every bandage, destined for a fracture of the neck of the humerus ought to fulfil. The last object merits less attention, than the two others, because the weight of the arm is alone almost sufficient for the purpose. Desault used to employ the following apparatus for the cure of fractures of the neck of the humerus.

1. Two bandages, one about five or six ells long; the other eight or ten; both about three inches wide. 2. Three strong splints, of different lengths, and between two and three inches broad. 3. A cushion or pillow, three or four inches thick at one of its ends, terminating at the other in a narrow point, and long enough to reach from the axilla to the elbow. 4. A sling to support the fore-arm. 5. A towel to cover the whole of the apparatus.

The reduction is to be effected as above explained, and the assistants are to continue the extension. Then the surgeon is to take the first roller, which is to be wet with the liq. plumbi acet. dil. and he is to fix one of its heads by applying two circular turns to the upper part of the fore-arm. The bandage is now to be rolled moderately tight round the arm upward, making each turn overlap two-thirds of that which is immediately below it. When the roller has reached the upper part of the limb, it must be doubled back a few times to prevent the folds, which the inequality of the part would create. The bandage is afterward to be carried twice under the opposite axilla, and the rest of it, rolled up, is to be brought up to the top of the shoulder, and committed to the care of an assistant.

The first splint is to be placed in front, reaching from the bend of the arm as high as

the acromion. The second, on the outside from the external condyle to the same height. The third, behind, from the olecranon to the margin of the axilla. The pillow, interposed between the arm and thorax, serves as a fourth splint, which becomes useless. An assistant applies these parts of the apparatus, and holds them on by applying his hands near the bend of the arm, in order not to obstruct the application of the remainder of the bandage.

The surgeon takes hold of the bandage again, and applies it over the splints with moderate tightness, and the bandage ends at the upper part of the fore-arm, where it began.

While the assistants continually keep up the extension, the surgeon is to place the pillow between the arm and trunk, taking care to put the thick end upward, if the fracture be displaced inward; but downward, if this should be displaced outward, which is most common. It is to be attached by two pins to the upper part of the roller.

The arm is to be brought near the trunk, and fixed upon the pillow, by means of the second roller, applied round the arm and thorax. The turns of this bandage should be rather tight below, and slackish above, if the fracture be displaced inward; but if outward, they should be slack below, and tight above.

The fore-arm is to be supported in a sling, and the whole of the apparatus is to be enveloped in a napkin, which will prevent the bandages from being pushed out of their places.

If the effect of the above apparatus in fulfilling the indications above specified is considered, we shall easily see, that they are very well accomplished. The arm, firmly fixed against the trunk, can only move with it, and then nothing displaces the lower end of the fracture, which is equally motionless. The shoulder cannot communicate any motion to the upper end of the fracture. The pillow, differently disposed, according to the direction, in which the lower extremity of the fracture is displaced, serves to keep this part in the opposite position.

Should this part of the bone project inward, the thick end of the pillow will remove it further from the chest. The bone will be kept at its distance from the side by the turns of the bandage, which, being very tight downward, will act upon the limb as a lever, the fulcrum for which will be the pillow, and the resistance, the action of the pectoralis major, latissimus dorsi, and teres major. Thus the bandage will have the effect of bringing the elbow nearer the trunk, and move the lower end of the fracture in the opposite direction, so that it may be here considered as an artificial muscle, directly opposing the natural ones.

When the lower end of the fracture is drawn outward, which is most commonly the case, the contrary effect will be produced, both from the pressure exercised by the bandage on the upper end of the displaced portion of the bone, and from the

situation of the elbow; which is kept outward by the thick parts of the pillow. The outer splint will also prevent the lower end of the fracture from being displaced outward, both by its mechanical resistance to the bone, and by compressing the deltoid muscle, which is the chief cause of such displacement. All displacement of the lower end of the fracture, forward, or backward, is prevented by the back splints; and as for the longitudinal displacement, which is already prevented by the weight of the limb, it is still more effectually hindered by the compression of the muscles of the arm, both by the splints and roller. (See *Œuvres Chir. de Desault, par Bichat, T. 1.*)

FRACTURES OF THE LOWER END OF THE OS BRACHII, WITH SEPARATION OF THE CONDYLES.

Fractures of the os brachii, with detachment of its condyles, seem to have escaped the notice of most authors, who have written on the diseases of the bones. The ancients have left us nothing upon the subject. Heister only mentions the fracture of the lower end of this bone, with a view of making an unfavourable prognosis. The accident, however, is not uncommon, and Desault, in particular, had frequent occasion to meet with it.

Whatever its causes may be, the two condyles are usually separated from each other by a longitudinal division, which, extending more or less upward, is bounded by another transverse, or oblique division, which occupies the whole thickness of the bone. Hence, there are three different pieces of bone, and two fractures.

Sometimes, the division is more simple. Then, taking a direction outward, or inward, it crosses obliquely downward the lower end of the os brachii, terminates in the joint, and only detaches one of the condyles from the body of the bone.

In the first case, the deformity is greater, and the fractured part is more moveable. When pressure is made, either before or behind, on the track of the longitudinal fracture, the two condyles becoming further separated from each other, leave a fissure between them, and the fractured part is widened. The fore-arm is almost always in a state of pronation. On taking hold of the condyles, and moving them in different directions, a distinct crepitus is perceived.

In the second case, the separation of the condyles from each other is not so easy; but, a crepitus can always be distinguished, on moving the detached condyle. In one case, in which the external condyle was the only one broken, Desault found the limb always supine: a position, which the muscles inserted into this part are, doubtless, concerned in producing.

In both cases, an acute pain, the almost inevitable effect of bending, or extending the fore-arm; an habitual half-bent state of this part of the limb, and sometimes a subsequent swelling of it, together with more

or less tumefaction round the joint, are observable. When the blow has been very violent, or a pointed piece of the bone protrudes through the flesh, these accidents may be complicated with a wound, splinters of bone, &c.

Former writers consider the communication of a fracture with a joint, a fatal kind of complication. Swelling and inflammation of the adjacent parts; continuance of pain after the reduction; large abscesses; even mortification of the soft parts, and caries of the bones, are, according to such authors, the almost inevitable consequences of these fractures, and ankylosis the most favourable termination. Paré, Petit, Heister, Duverney, all give this exaggerated picture. However, analogous fractures of the olecranon and patella prove, that this representation is magnified beyond truth. Modern observation has dispelled the ancient doctrine of the effusion of callus into the joint; and with it one of the principal causes, assigned by authors for the symptoms so much dreaded.

The communication of the cavity of the joint with the external air might be thought to have more real influence; but, this can only occur in compound fractures, and Desault had often learned from experience, that the contact of air is not so dangerous, as has been supposed.

The general cause of all the ill consequences, seen in former times, was erroneous treatment, as may be inferred from the success which attended the extensive practice of Desault.

The detached condyles, being drawn in opposite directions by the muscles of the arm and fore-arm, commonly remain unmoved between these two powers, and are but little displaced. External force may, however, put them out of their proper situation, and they may then be displaced forward, or backward, or they may separate from each other sideways, leaving an interspace between them. Hence, the apparatus should resist them in these four directions, and this object is easily accomplished by means of four splints, kept on with a roller. The two lateral splints are particularly necessary, when the condyles are separated from the body of the bone, with an interspace between them. If one of them be still continuous with the humerus, no splint on this side will be requisite.

The apparatus need not extend as high as when the arm is fractured higher up. Of what avail in steadying the fractured part, are the circles of the bandage, applied to the body of the bone, so much above the injury? Their only utility would consist in restraining the action of the brachialis and triceps, by compressing these muscles.

On the other hand, the roller should be continued over the fore-arm, in order that the joint, according to the judicious precept of Paulus Aegineta, may correspond to the middle of the bandage, which should here be firmer than any where else. This method is also of use in producing a gentle com-

pression of the muscles implanted into the condyles.

Desault recommends having the front and back splints flexible at their middle part, which should be applied to the bend of the arm and elbow. (*Œuvres Chir. de Desault, par Bichat, T. 1*)

The detail of the reduction of the fracture and application of the roller and splints, becomes useless after what has been said. A further account may be found in the work mentioned in the preceding paragraph. The arm is to be kept in the bent position in a sling, and perfectly quiet, until it is judged advisable to begin to move the joint for the purpose of preventing an anchylosis.

FRACTURE OF THE FORE-ARM.

The fore-arm is more frequently broken than the arm, because external force operates more directly upon it than the latter part, especially in falls on the hands, which are frequent accidents.—Bichat, in his account of Desault's practice, mentions, that fractures of the fore-arm often held the first place in the comparative table of such cases, kept at the Hôtel Dieu.

We know that the fore-arm is composed of two bones, the ulna and radius. The last is much more liable to fractures than the first, because it is articulated with the hand by a large surface. All the shocks received by the latter part, are communicated to the radius. The situation of this bone more immediately exposes it to such causes as may break it; a circumstance which we may readily convince ourselves of on the first inspection. Both bones of the fore-arm may be broken at the same time, or one alone may be fractured.

FRACTURES OF BOTH BONES

May occur at the extremities, or middle of the fore-arm. They are frequent at the middle; very common below; but seldom happen at the upper part of the fore-arm, where the numerous muscles, and the considerable thickness of the ulna, resist causes which would otherwise occasion the accident. The bones are usually broken in the same line; but sometimes in two different directions. The fracture is almost always single; but in a few instances it is double, and Desault, in particular, was one day called to a patient, over whose fore-arm the wheels of a cart had passed, so as to break the bones, at the middle and lower part, into six distinct portions. The middle ones, notwithstanding they were quite detached, united very well, with hardly any deformity.

These accidents are most commonly occasioned by direct external violence; but sometimes they are produced by a counter-stroke, which is generally the case when the patient falls on his hand. But in this instance, as the hand is principally connected with the lower broad articular surface of the radius, this bone alone has to sustain almost the

whole shock of the blow, and hence, is usually the only one broken.

The symptoms indicating fractures of the fore-arm, are not likely to lead the surgeon into any mistake: motion at a part of the limb, where it was previously inflexible; a crepitus, almost always easily felt; sometimes a distinct depression in the situation of the fracture; a projection of the ends of the fracture beneath the skin, but a less common symptom; pain on moving the part; a noise sometimes audible to the patient at the moment of the accident; an inability to perform the motion of pronation and supination; and an almost constant half-bent state of the fore-arm.

There is one case, however, in which the fracture being very near the wrist-joint, similar appearances to those of a dislocation of this part may arise. But, attention to whether the styloid processes are above, or below, the deformity, will discover whether the case be a fracture or dislocation. In a fracture, the part is also more moveable, and there is a crepitus. (*Œuvres Chir. de Desault, par Bichat, T. 1.*) According to Boyer, the two cases may be distinguished by simply moving the hand, by which motion, if there be a luxation without fracture, the styloid processes of the radius and ulna will not change their situation; but, if a fracture exist, they will follow the motion of the hand.

The connexion of the two bones of the fore-arm, by the interosseous ligament, which occupies the interspace by which they are separated, and the manner in which the muscles attached to both, are inserted into them, render any displacement of the broken pieces in the longitudinal direction very difficult; and in reality, such displacement is seldom observed, and never in any considerable degree. When it does take place, it is to be ascribed to the cause of the fracture, rather than to muscular contraction. On the contrary, in the transverse displacement, the four pieces approach one another, and the interosseous space is diminished or entirely obliterated near the seat of the fracture; attended with evident deformity of the part. There is an angular displacement, which the fracturing cause always produces, either forward or backward, according to its direction.

Boyer gives the following account of the treatment of the fracture of both bones of the fore-arm.

The fore-arm is to be bent to a right angle with the arm, and the hand placed in a position between pronation and supination. The fore-arm and hand being thus placed, an assistant takes hold of the four fingers of the patient, and extends the fractured parts, while another assistant makes counter-extension by fixing the humerus with both his hands. By these means, the operator is enabled to restore the bones to their natural situation, and to push the soft parts into the interosseous space, by a gentle and graduated pressure on the anterior and posterior sides of the arm.

The bones are kept in their place by ap-

plying first on the anterior and posterior sides of the fore-arm two longitudinal and graduated compresses, the base of which is to be in contact with the arm. The depth of these compresses should be proportioned to the thickness of the arm, increasing as the diameter of the arm diminishes. In the next place, the surgeon takes a single-headed roller about six yards long, and makes three turns of it on the fractured part; he then descends to the hand by circles partially placed over one another, and envelops the hand by passing the bandage between the thumb and index finger; the bandage is next carried upward in the same manner, and reflected wherever the inequality of the arm may render it necessary. The compresses and bandage being thus far applied, the surgeon lays on two splints, one anteriorly, the other posteriorly, and applies the remainder of the bandage over them. The compresses and splints should be of the same length as the fore-arm. It would be useless to employ lateral splints in this case, unless (what is scarcely ever to be expected or met with) a displacement should have taken place in that direction. Lateral splints would counteract the compresses and two other splints, by lessening the radio-cubital diameter of the arm, and with the action of the pronators tend to push the ends of the fracture into the interosseous space. The surgeon's attention should be particularly directed to preserve the interosseous space; for, if this be obliterated, the radius cannot rotate on the cubitus, nor the motion of pronation or supination be executed; and this object may be obtained with certainty by applying the compresses and splints in such a manner, that the fleshy parts may be forced into, and confined in the interosseous space, and by renewing the bandage every seven or eight days.

If the fracture be simple, and the contusion inconsiderable, the patient need not be confined to bed; but may walk about with his arm in a sling.

FRACTURES OF THE RADIUS

Are the most frequent of those of the fore-arm. The radius being almost the sole support of the hand, and placed in the same line with the humerus, is for both these reasons more exposed to fractures, than the ulna.

Fractures of the radius, whether transverse or oblique, near its middle part or extremities, may be caused by a fall or blow on the fore-arm, or, as happens in most cases, by a fall on the palm of the hand. When likely to fall, we extend our arms, and let the hands come first to the ground; in which case, the radius, pressed between the hand on the ground, and the humerus, from which it receives the whole momentum of the body, is bent, and, if the fall be sufficiently violent, broken more or less near its middle part. When, after an accident of this kind, pain, and difficulty of performing the motions of pronation and supination, supervene, the probability of a fracture of

the radius is very strong. The truth is fully ascertained by pressing with the fingers along the external side of the fore-arm. Also, in endeavouring to perform supination or pronation of the hand, a crepitus and a motion of the broken portions will be perceived. When the fracture takes place near the head of the radius, the diagnosis is more difficult, on account of the depth of soft parts over that part of the bone. In this case, the thumb is to be placed under the external condyle of the os humeri, and on the superior extremity of the radius, and at the same time the hand is to be brought into the prone and supine positions. If, in these trials, which are always painful, the head of the radius rests motionless, there can be no doubt of the bone being fractured. Here the causes of displacement are the same as in fractures of the fore-arm; it can never take place, except in the direction of the diameter of the bone, and is effected principally by the action of the pronating muscles. The ulna serves as a splint in fractures of the radius; and the more effectually, as these two bones are connected with one another throughout their whole length.

In general, when only the radius is fractured, no extension is requisite. During the treatment, the elbow is to be bent, and the hand put in the mid-state, between pronation and supination; that is to say, the palm of the hand is to face the patient's breast. Having reduced the ends of the fracture, when they appear to be displaced, the soap plaster is to be applied, and over this a slack roller. This bandage is, indeed, of no utility; but, it makes the limb seem to the unknowing by-standers more comfortable, than if it were omitted, and, as it does no harm, the surgeon may honestly apply it. However, no one can doubt, that tight bandages may act very perniciously, by pressing the radius and ulna together, causing them to grow to each other, or, at all events, making the fracture unite in an uneven manner. Only two splints are necessary; one is to be placed along the inside, the other along the outside, of the fore-arm. Soft pads must always be placed between the skin and the splints, in order to obviate the pressure of the hard materials, of which the latter are formed. The inner splint should extend to about the last joint of the fingers; but, not completely to the end of the nails; for, many patients, after having had their fingers kept, for several weeks, in a state of perfect extension, have been a very long time in becoming able to bend them again.

Sometimes, it may be proper to apply a compress just under the ends of the fracture, to prevent their being depressed toward the ulna too much, the consequence of which has occasionally been the loss of the prone and supine motions of the hand.

In setting a fractured radius, the hand should be inclined to the ulnar side of the fore-arm.

FRACTURES OF THE ULNA.

Fractures of this bone are less frequent.

than those of the radius, and takes place generally at its lower extremity, which is most slender, and least covered. A fracture of this bone is almost always the result of a force acting immediately on the part fractured; as, for instance, when, in a fall, the internal side of the fore-arm strikes against a hard resisting body. On applying the hand judiciously to the inside of the fore-arm, this fracture is easily ascertained by the depression at that part, in consequence of the inferior portion being drawn toward the radius by the action of the pronator radii quadratus. This displacement, however, is less considerable than what takes place in fractures of the radius. The superior portion of the ulna remains unmoved. (*J. L. Petit.*)

In this case, the assistant, who makes whatever little extension may be necessary, should incline the hand to the radial side of the fore-arm, while the surgeon pushes the flesh between the two bones, and applies the apparatus, as in the preceding case. In all fractures of the bones of the fore-arm, and, particularly, in those which are near the head of the radius, a false ankylosis is to be apprehended, and should be guarded against by moving the elbow gently and frequently, when the consolidation is in a certain degree advanced.

Fractures of the fore-arm always require the part to be kept quietly in a sling.

FRACTURES OF THE OLECRANON.

The olecranon may be fractured either at its base, or its extremity; but, the first occurrence is the most frequent. The division is almost always transverse, though occasionally oblique. The accident is very rarely produced by the action of the muscles, but almost always by external violence, directly applied to the part in a blow, or fall upon the elbow.

With regard to symptoms, the contraction of the triceps, being no longer resisted, by any connexion with the ulna, draws upward the short fragment, to which it adheres; so as to produce, between it and the lower one, a more or less evident interspace. This interspace is situated at the back part of the joint, and may be increased or diminished at will, by augmenting the flexion of the fore-arm, and putting the triceps into action, or else extending the limb. Another symptom, is the impossibility of spontaneously extending the fore-arm, the necessary effect of the detachment of the triceps from the ulna. The fore-arm is constantly half bent, the biceps, and brachialis having no antagonists. The olecranon is, more or less conspicuously, drawn up higher than the condyles of the os brachii, which latter parts, on the contrary, are naturally situated higher than the olecranon, when the fore-arm is half bent. The upper piece of bone may be moved in every direction, without the ulna participating in the motion. Besides these symptoms, we must take into the account, the considerable pain experienced, the crack sometimes distinctly heard by the patient, and the crepitus which is frequently perceptible.

The indications are to push downward the retracted portion of the olecranon, and to keep it in this position, at the same time that the ulna is made to meet it, as it were, by extending the fore-arm. According to Desault, however, the fore-arm should not be completely extended, as when the pieces of bone touch at their back part, they leave a vacancy in front, which is apt to be followed by an irregular callus, prejudicial to the free motion of the elbow. Hence, it was his practice to put the arm between the half bent state and extension. This posture, however, would soon be changed, if permanent means were not taken to maintain it. Desault, with this view, applied a splint along the forepart of the arm. But, as position evidently operates only on the lower part of the olecranon, the upper one requires to be brought near the former, and fixed there, which is, doubtless, the most difficult object to effect, because the triceps is continually resisting.

Desault used to adopt the following method: the fore-arm being held in the above position, the surgeon is to begin applying a roller round the wrist, and to continue it as high as the elbow. The skin, covering this part, being wrinkled in consequence of the extension of the limb, might insinuate itself between the ends of the fracture, and consequently it must now be pulled upward by an assistant. The surgeon is then to push the olecranon towards the ulna, and confine it in this situation with a turn of the roller, with which the joint is then to be covered, by applying it in the form of a figure of 8.

A strong splint, a little bent, just before the elbow, is next laid along the arm and fore-arm, and fixed by means of a roller. The apparatus being applied, the whole limb is to be evenly supported on a pillow.

The cure of the fractured olecranon is seldom effected by the immediate reunion of its fragments: there generally remains a greater or lesser interspace between them, which is filled up by a substance not of a bony consistence. It is true, such interspace is smaller when the fore-arm has been kept extended; but, this advantage does not at all counterbalance the unpleasant stiffness of the joint, which is the inevitable consequence of a posture so unfavourable to the functions of the limb. (*Boyer, Traité des Maladies Chir. T. 3, p. 226.*) This author cites several facts, which prove, that when the fractured olecranon is entirely neglected from the case not being understood, the fragments are still united by a ligamentous substance, and that when an interspace of half an inch is thus left between them, the strength and motion of the elbow become perfect.

Camper laid great stress upon the inutility of keeping the arm perfectly extended: he found patients recover sooner and better, when the elbow was kept half bent, and the joint gently exercised at as early a period as possible. "*Agglutinationem scilicet motiri non debet chirurgus, sed sublati tumore ac*

inflammatione quiete et remediis aptis, cubitum quotidie prudenter movere, ut unio per tricipitis tendinem, seu per concretionem membranosa formetur, et os ossi non admoveatur. Verbo quemadmodum C. Celsus in *Med. Lib. 8 c. 10, § 4, p. 537*, de cubito fracto præcepit. Quod si ex summo cubito quilibet fractum sit, glutinare id vinciendo alienum est, fit enim brachium immobile, ac, si nihil aliud quam dolori occurrendum est, idem qui fuit ejus usus est." (*Camper de Fractura Patellæ, p. 66, Hagæ, 1789.*) The late Mr. Sheldon, however, does not concur with Desault and Camper, respecting the position of the limb during the treatment, but insists upon the utility of keeping the fore-arm perfectly extended. The main objection to the endeavour to effect a close bony union, is the general impossibility of doing this in such a manner, that the extremity of the olecranon will afterward adapt itself precisely to the hollow designed for its reception at the back of the humerus.

On an average, the olecranon becomes firmly united about the twenty-sixth day. (*Desault par Bichat.*)

FRACTURES OF THE CARPAL AND METACARPAL BONES, AND PHALANGES OF THE FINGERS.

The bones of the carpus, when broken, are usually crushed, as it were, between very heavy bodies, or the limb has been entangled in powerful machinery, or suffered gunshot violence. It must be obvious, therefore, that, as the soft parts are also seriously injured, these cases are generally followed by severe and troublesome symptoms, and sometimes require the performance of amputation, either immediately, or subsequently. When an attempt is to be made to save the part, the chief indications are to extract splinters of bone, and prevent inflammation, abscesses, and mortification. The parts may at first be kept wet with a cold evaporating lotion, any wound present being lightly and superficially dressed, but, afterward, as soon as all tendency to bleeding is over, emollient poultices may be applied over the dressings, instead of the lotion. The dressings themselves, however, should not be removed for the first three or four days, all unnecessary disturbance of the crushed parts being highly injurious. Should abscesses form, early openings should be practised, so as to prevent the matter from extending up the fore-arm. Duly supporting the hand and fore-arm in a sling is of the greatest importance. The metacarpal bones of the little finger and thumb are more frequently broken, than the other three. A fracture of a metacarpal bone is generally produced by violence applied directly to the part, as no force, capable of causing the accident, can well act upon the two ends of the bone so as to break it. The fracture may be simple, but, more commonly it is compound, the soft parts being wounded, and lacerated by the same violence, which has injured the bone.

In most cases, also, unless the force has operated by a very limited surface, more than one metacarpal bone is fractured. At first the same kind of treatment is requisite, as in the preceding cases, and after the inflammation has subsided, a hand-board, or splint may be employed. When the hand is very badly crushed, amputation is indicated.

In fractures of the finger bones, the treatment consists in applying a piece of soap-plaster, rolling the part with tape, incasing it in pasteboard, sometimes placing the hand on a flat splint, or finger-board, and always keeping the hand, fore-arm, and elbow, well supported in a sling.

For Fractures of the Cranium, see *Head, Injuries of.*

For information on fractures consult particularly, *J. L. Petit, Traité des Maladies des Os*; *Duvernoy, Traité des Maladies des Os*. *Jonathan Wathen, the Conductor and Containing Splints*; or a *Description of Two New invented Instruments, for the more safe Conveyance, as well as the more easy and perfect Cure of Fractures of the Leg, 2d Ed. 8vo. Lond. 1767.* *W. Sharp in Vol. 57, of the Philosophical Trans. part 2, 1767.* *An Account of a new Method of treating Fractured Legs. Pott's Remarks on Fractures, and Dislocations. T. Kirkland, Obs. upon Mr. Pott's general Remarks on Fractures, &c. 8vo. Lond. 1770; also Appendix to the same, 8vo. Lond. 1771.* *Cases in Surgery by C. White, Edit. 1770.* *J. Aiken, Essays on several Important Subjects in Surgery, chiefly on the Nature of Fractures of the Long Bones of the Extremities, particularly those of the Thigh and Leg, 8vo. 1771.* *Boyer, Leçons sur les Maladies des Os, rédigées en un Traité complet de ces Maladies, par Richerand, or the English Translation by Dr. Farrell; also, Boyer, Traité des Mal. Chir. T. 3. Encyclopédie Methodique, Partie Chir. Art. Fracture, Ouisse, Omoplate, Ilium, &c. &c. Œuvres Chir. de Desault, par Bichat. T. 1. Parts of the Parisian Chirurgical Journal. Sir J. Earle, A Letter containing some Observations on the Fractures of the lower limbs; to which is added an Account of a Contrivance to administer Cleanliness and Comfort to the bed-ridden, or persons confined to bed by age, accident, sickness, or other infirmity. 8vo. Lond. 1807. Richerand, Nosographie Chir. T. 3. Edit. 4. Leveillé, Nouvelle Doctrine Chir. T. 2, 1812. Assalini, Manuale de Chirurgia, Parte Prima, Milano, 1812. Dupuytren, des Fractures ou Courbures des os des Enfans, in Bulletin de la Faculté de Med. Paris, 1811. Idem sur la Fracture de l'Extrémité inférieure du péroné, les luxations, et les accidens qui en sont la suite, in Annuaire Med. Chir. de Paris, 4to. Paris, 1819. Roux, Relation d'un Voyage fait à Londres en 1814, ou Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise, p. 173, &c. Paris, 1815. Med. Chir. Trans. Vol. 2, p. 47, &c.; Vol. 5, p. 358, &c.; Vol. 7, p. 103 Sketches of the Medical Schools of Paris, by J. Cross, p. 87, &c.*

FRÆNUM LINGUÆ. In infants, the tongue is sometimes too closely tied down, by reason of the frænum being extremely

short, or continued too far forwards. In the latter case, the child will not be able to use its tongue with sufficient ease in the action of sucking, swallowing, &c. in consequence of its point being confined at the bottom of the mouth. Though this affection is not unfrequent, it is less common than is generally supposed by parents and nurses. When the child is small, and the nurse's nipple large, it is common for her to suppose the child to be tongue-tied, when, in fact, it is only the smallness of the child's tongue that prevents it from surrounding the nipple, so as to enable it to suck with facility. Mothers also commonly suspect the existence of such an erroneous formation whenever the child is long in beginning to talk.

The reality of the case may always be easily ascertained by examining the child's mouth. In the natural state, the point of the tongue is always capable of being turned upward, towards the palate, as the frænnum does not reach along about a quarter of an inch of the lower part of the tongue from the apex. But, in tongue-tied children, by looking upon one side, we may see the frænnum extending from the back part to the very point, so that the whole length of the tongue is tied down, and unnaturally confined.

The plan of cure is to divide as much of the frænnum as seems proper for setting the tongue at liberty. The incision, however, should not be carried more extensively backward, than is necessary, lest the raninal arteries be cut; an accident, that has been known to have proved fatal. For the same reason, the scissors used for this operation, should have no points. I think the following piece of advice, offered by a modern author, may be of service to practitioners, who ever find it necessary to divide the frænnum linguæ: "It is not the relations of the trunk of the lingual artery alone which the student ought to make himself acquainted with. He will do well to study the position of the arteria ranina in respect to the frænnum linguæ. This information will teach him the impropriety of pointing the scissors upward and backward, when snipping the frænnum, an operation, by the by, oftener performed than needed. He will learn, that the ranular artery lies just above the attachment of the frænnum; so that if he would avoid it, he must turn the points of the scissors rather downward; if he do not, the artery will probably suffer." (*A. Burns, Surgical Anatomy of the Head and Neck*, p. 239.)

When an infant has the power of sucking, this proceeding should never be resorted to, even though the frænnum may have the appearance of being too short, or extending too far forwards. (*Fab. Hildanus, centur. 3, Obs. 28; Petit, Traité des Mal. Chir. T. 3, p. 265, Edit. 1774.*)

Although the operation of dividing the frænnum linguæ is for the most part done without any bad consequences, surgeons should remember well, that it is liable to dangers, especially when performed either unnecessarily, or unskilfully.

Besides the fatal events, which have occasionally resulted from wounding the raninal arteries, the records of surgery furnish us with proofs, that the mere bleeding from the raninal veins, and the small vessels of the frænnum, may continue so long, in consequence of the infant's incessantly sucking as to produce death. In such cases, the child swallows the blood, as fast as it issues from the vessels, so that the cause of death may even escape observation. But, if the body be opened, the stomach and intestines will be found to contain large quantities of blood. (*See Dionis, Cours d'Operations de Chirurgie, 7e Demonstration; Petit, Traité des Maladies Chir. T. 3, p. 282, &c.*)

Another accident, sometimes following an unnecessary, or too extensive a division of the frænnum, consists in the tongue becoming thrown backward over the glottis into the pharynx, where it lies fixed, and causes suffocation. The observations of Petit on this subject are highly interesting. (*See Op. cit. T. 3, p. 267, &c.*)

Lastly, it should be known, that an infant's inability to move its tongue, or suck, is not always owing to a malformation of the frænnum. Sometimes the tongue is applied and glued, as it were, to the roof of the mouth, by a kind of mucous substance, and in this case, it should be separated with the handle of a spatula. By this means, infants have been saved, which were unable to suck during several days, and were in imminent danger of perishing from want of nourishment. (*See Mémoires de l'Acad. de Chirurgie, T. 3, p. 16, Edit. 4to.*)

See particularly *Petit, Traité des Maladies Chir. T. 3, p. 260, &c. Dionis Cours d'Operations, 7e Demonstr. Sabatier, Médecine Opératoire, T. 3, p. 132, &c. Lassus, Pathologie Chir. T. 2, p. 454. Richerand, Nosogr. Chir. T. 3, p. 284. Ed. 2. Richter, Anfangsgr. der Wundarzn. B. 4, Kap. 2, p. 11, Ed. 1800.*

FRAGILITAS OSSIUM. A morbid brittleness of the bones.

Boyer imputes *mollities ossium* to a deficiency of lime in their structure; *fragilitas ossium* to a deficiency of the soft matter naturally entering into their texture. He states, that a certain degree of *fragilitas ossium* necessarily occurs in old age, because the proportion of lime in the bones naturally increases as we grow old, while that of the organized part diminishes. Hence, the bones of old persons more easily break than those of young subjects, and are longer in uniting again. As Mr. Wilson observes, however, they never are found so friable and fragile, as to crumble like a calcined bone, but on the contrary, they contain a large quantity of oil, a fact particularly noticed by Saillant, (*see Hist. de la Société de Med. 1776, p. 316,*) and after death dry so greasy, that they are unfit to be preserved as preparations. Their organized vascular part is diminished, but their oily animal matter is increased. (*On the Skeleton and Diseases of Bones, p. 258.*)

In persons who have been long afflicted with cancerous diseases, the bones are said

to become sometimes as brittle, as if they had been calcined. Saviard and Louis relate cases of this description. (*Obs. Chir. et Journ. de Savans*, 1691. *Obs. et Remarques sur les effets du Virus Cancereux*, Paris, 1750. *Ponteau Œuvres Posthumes*, T. 1.) Louis mentions a nun who broke her arm by merely leaning on a servant; and in the London Medical Journal an account is given of a person, who could not even turn in bed, without breaking some of his bones.

In the latter stage of syphilis, the bones are alleged to be sometimes remarkably brittle. (*Ephem. Nat. Cur. Dec. 1. Ann. 3, Obs. 112. Walther, Museum Anat. T. 2, p. 29.*)

In bad cases of scurvy, the bones occasionally become so brittle, that they are broken by the slightest causes, and do not grow together again. (*Foettcher von den Krankh. der Knochen. p. 68.*)

The fragilitas ossium of old age is incurable; that which depends on some other constitutional disease can only be relieved by a removal of the latter. (See *Boyer on Diseases of the Bones*, Vol. 2.)

This author, in one of his last works, expresses his opinion, that the doctrine of molities and fragilitas ossium being distinct different diseases, is by no means sufficiently proved by a due number of accurate observations. (*Traité des Mal. Chir. T. 3, p. 607, 608.*) Consult also Waldschmidt, *Diss. de Fractura Ossium sine Causâ violentâ externâ. Kilon. 1721. Acrel, Chir. Vorfälle 2, p. 136. Courtial, Nouvelles Obs. Anat. sur les Os, p. 64, 12mo. Paris, 1705. Marcellus Donatus, Lib. 6, c. 1, p. 528. Walther, Museum Anat. Vol. 2, p. 29. Schmucker, Vermischte Schrift-en, 1 B. p. 385. Kentish, in Edinb. Med. Comment. Vol. 1. Hist. de l'Acad. des Sciences, 1765, p. 65. Hist. de la Soc. Royale de Medecine, 1777 and 1778, p. 224. Journ. de Med. T. 77, p. 267, T. 84, p. 216. Isenflam. Pract. Bemerk. über Knochen. p. 368, 415, 466. Fabricius Hildanus, Cent. 2. Obs. 66, 67, 68, Cent. 5, Obs. 89. D'Aubenton, Description du Cabinet du Roi, T. 3, Ossa Veneorum sponte fracta. Meckren, Obs. Med. Chir. p. 341, Amst. 1682. Wiedmann de Necrosi Ossium, p. 2, Francofurti, 1793; and the writings of Duverney, Petit, and Pringle. J. Wilson on the Skeleton, &c. p. 258, 8vo. Lond. 1820.*

FUNGUS. Any sponge-like excrescence. Granulations are often called *fungous* when they are too high, large, flabby, and unhealthy.

FUNGUS HÆMATODES. (from *fungus*, and *agua*, blood.) The Bleeding Fungus. Spongoid Inflammation. Soft Cancer. Carcinome Sanguilante. Medullary Sarcoma.

This disease, which has been accurately described only of late years, was formerly generally confounded with cancer. The public are indebted to Mr. J. Burns, of Glasgow, for the first good account of it; and the subsequent writings of Mr. Hey, of Leeds, Mr. Freer, of Birmingham, Mr. J. Wardrop, Mr. Langstaff, and others, have

made us still better acquainted with the subject.

It is unquestionably one of the most alarming diseases, incidental to the human body, because we know of no specific remedy for it; and an operation can only be useful at a time, when it is very difficult to persuade a patient to submit to it.

Indeed, when the diseased part is extirpated at an early period, a recovery hardly ever follows; for, experience proves, that it is not a disease of a local nature, but almost always extends to a variety of organs and structures at the same time, either to the brain, the liver, or lungs, &c. It is of the utmost consequence to be aware of this fact, since we should otherwise be induced to attempt many hopeless operations, and deliver a prognosis, that might cause disappointment and censure. In a large proportion of patients, afflicted with fungus hæmatodes, the general disorder of the system is indicated by a peculiarly unhealthy aspect; a sallow, greenish yellow colour of the skin, which is frequently covered with clammy perspiration; constant troublesome cough; difficulty of breathing, &c.

Fungus Hæmatodes, is the name used by Mr. Hey. Mr. J. Burns has called the disease *spongoid inflammation*, from the spongy elastic feel, which peculiarly characterizes it, and which continues even after ulceration takes place. The fungus hæmatodes has most frequently been seen to attack the eyeball, the upper and lower extremities, the testicle, and the mamma. But, the uterus, ovary, liver, spleen, brain, lungs, thyroid gland, hip, and shoulder joints, have also been the seat of the disease. A distemper, which presents itself in so many parts, must be subject to variety in its appearances.

FUNGUS HÆMATODES OF THE EYE.

1. When it attacks the eye, the first symptoms are observable in the posterior chamber, an appearance, like that of polished iron, presenting itself at the bottom of the eye. (*Scarpa on Diseases of the Eye, p. 505, Ed. 2.*) The pupil becomes dilated and immoveable, and, instead of having its natural deep black colour, it is of a dark amber, and sometimes of a greenish hue. The change of colour becomes gradually more and more remarkable, and, at length is discovered to be occasioned by a solid substance, which proceeds from the bottom of the eye towards the cornea. The surface of this substance is generally rugged and unequal, and ramifications of the central artery of the retina may sometimes be seen running across it. The front surface of the new mass, at length advances as far forwards as the iris, and the amber, or brown appearance of the pupil, has, in this stage, been known to mislead surgeons into the supposition of there being a cataract, and make them actually attempt couching. The disease continuing to increase, the eyeball loses its natural figure, and assumes an irregular knobby appear-

ance. The sclerotica also loses its white colour, and becomes of a dark blue, or livid hue. Sometimes, matter now collects between the tumour and the cornea. The latter membrane in time ulcerates, and the fungus shoots out. In a few instances, it makes its way through the sclerotica, and is then covered by the conjunctiva. The surface of the excrescence is irregular, often covered with coagulated blood, and bleeds profusely from slight causes. When the fungus is very large, the most prominent parts slough away, attended with a fetid sanious discharge. In the course of the disease, the absorbent glands, under the jaw, and about the parotid gland, become contaminated. On dissection, a diseased mass is found extending forwards from the entrance of the optic nerve, the vitreous, crystalline, and aqueous humours being absorbed. The retina is annihilated, and the choroid coat propelled forwards, or quite destroyed. The tumour seems to consist of a sort of medullary matter, resembling brain. The optic nerve is thicker and harder than natural, of a brownish ash-colour, and destitute of its usual tubular appearance. In other cases, the nerve is split into two or more pieces, the interspaces being filled up with the morbid growth. (*Wardrop*.) Nay, as Mr. Travers has stated, the optic ganglion, tractus opticus, and thalamus, have been repeatedly found diseased, and the surrounding adipose substance in the orbit affected to a considerable extent in places also where there was no direct communication with the diseased contents of the globe. (*Synopsis of the Diseases of the Eye*, p. 221.) Even the brain has been observed to share in the disease, sometimes dark red spots appearing on the dura mater; sometimes small spots, containing a fluid like cream, being found between the pia mater, and tunica arachnoides. Mr. Travers has a preparation, exhibiting a genuine example of the disease affecting the anterior right lobe of the cerebrum, and protruding the eye from its socket, while the eye itself was perfectly free from disease. (*Op. cit.* p. 223.) When the lymphatic glands at the angle of the jaw are enlarged, as they frequently are, they are also found converted into a kind of medullary matter, similar to that which composes the diseased mass in the eyeball. When the skin bursts over a diseased absorbent gland, a sloughy ulcer is produced; but, no fungus is emitted, unless the affection of the gland with fungus hæmatodes be primary. Fungus hæmatodes of the eye has been erroneously regarded as cancer by the best writers. We learn from Bichat, that more than one-third of the patients on whom Desault operated for supposed carcinoma of the eye, were under twelve years of age. Twenty out of twenty-four cases of fungus hæmatodes of the eye, with which Mr. Wardrop has been acquainted, happened to children under twelve years of age. Now, as cancer is rather a disease of aged, than young persons, and we find, from Mr. Wardrop, that fungus hæmatodes of the eye mostly affects persons

under twelve years of age, it is tolerably certain, that most of Desault's cases, reported to be cancers of the eye, were in fact the equally terrible disease now engaging our consideration. According to Mr. Travers, the only parts of the eye and its appendages, subject to be primarily attacked by cancer, are the lachrymal gland, conjunctiva, and eyelids; while the evidence of many cases has assured him, that fungus hæmatodes may originate in any texture of the eye, with the exception of the lens and cornea. (*Synopsis of the Diseases of the Eye*, p. 216, 222, and 421.) This account, however, differs from that delivered by Mr. Wardrop and Professor Scarpa, who describe the disease as first commencing in the retina, and particularly at the point, where the optic nerve enters the eye. "For, (says the latter author,) on the first appearance of the yellowish or greenish spot, the retina on examination is found to be entirely deficient, or in other words, to have degenerated into the malignant fungus. It is also found, that the choroid membrane, while the fungus hæmatodes is in its incipient state, does not appear to have suffered any remarkable alteration in its texture, and that is only at a more advanced period of the disease, that this membrane becomes thickened, and separated from its connexion with the sclerotica. The choroid membrane even in the most advanced stage of the disorder, preserves more than all others, its natural texture." (*On the Principal Diseases of the Eyes*, p. 507, Ed. 2.) In cases of fungus hæmatodes, the sight of young subjects is generally destroyed, before the attention of parents is excited to the distemper. Frequently, however, a blow, followed by ophthalmia, precedes the growth of the diseased mass. When no external violence has occurred, the first symptom is a trivial fullness of the vessels of the conjunctiva, the iris becoming, at the same time, extremely vascular, and altered in colour, and the pupil dilated and immovable. There is seldom much complaint made of pain; but, the child is sometimes observed to be languid and feverish. In adults, fungus hæmatodes of the eye generally comes on without any apparent cause, though sometimes in consequence of a blow. At first, the tunica conjunctiva is slightly reddened, and vision indistinct. The redness and obscurity of sight increases slowly, and an agonizing nocturnal headach is experienced, the eye bursts, and the humours are discharged.

With regard to the cure of the fungus hæmatodes of the eye, the only chance of effecting this desirable object depends upon the early extirpation of the diseased organ. It must be acknowledged, however, that most of the operations, in which the morbid eye has been removed, have hitherto proved unsuccessful, owing to a recurrence of the disease. The reason of such ill success may be imputed to the optic nerve and other parts being almost always in a morbid state; before an attempt is made to remove the eye. One case, however, described by Mr. Tra-

vers, as having its seat in the cellular texture connecting the conjunctiva to the cornea, was operated upon, and no recurrence of the disease had occurred a twelvemonth afterward. No other texture was affected more, than the contiguity and extent of the disease explained. (*Synopsis of the Diseases of the Eye*, p. 413.) The operation has always been found to fail, when the disease is advanced so far, that the posterior chamber is filled by the fungous mass. Since no internal medicines, nor external applications, afford the least hope of checking any form of the fungus hæmatodes, it is manifest, that when the distemper of the eye exceeds certain bounds, the miserable patient is placed beyond the reach of any effectual aid from surgery. In a case, however, which I saw in April, 1821, in the London Eye Infirmary, the disease formed a diseased mass as large as an orange, accompanied with enlarged lymphatic glands over the parotid. The patient was an infant. In this instance, Mr. Lawrence used as a local application, the liquor opii sedativus, prepared by Mr. Battley, which was found to lessen considerably the child's sufferings. (See particularly *Wardrop's Obs. on Fungus Hæmatodes*. *Scarpa on the Principal Diseases of the Eye*, chap. 21. *Some Cases in Saunders's Treatise on Diseases of the Eye*; and *B. Travers's Synopsis of the Diseases of the Eye*, 8vo. Lond. 1820.)

FUNGUS HÆMATODES OF THE LIMBS.

2. In the extremities, the disease begins with a small colourless tumour, which is soft and elastic, if there be no thick covering over it, such as a fascia; but otherwise it is tense. At first, it is free from uneasiness; but, by degrees, a severe, acute pain darts occasionally through it, more and more frequently, and at length, becomes incessant. For a considerable time, the tumour is smooth and even; but afterward, it projects irregularly at one, or more points; and the skin at this place becomes of a livid red colour, and feels thinner. In this situation, it easily yields to pressure, but instantly bounds up again. Small openings now form in these projections, through which is discharged a thin bloody matter. Almost immediately after these tumours burst, a small fungus protrudes, like a papilla, and this rapidly increases, both in breadth and height, and has exactly the appearance of a carcinomatous fungus, and frequently bleeds profusely. The matter is thin, and exceedingly fetid, and the pain becomes of the smarting kind. The integuments, for a little way round these ulcers, are red, and tender. After ulceration takes place, the neighbouring glands swell, and assume exactly the spongy qualities of the primary tumour. If the patient still survive the disease in its present advanced progress, similar tumours form in other parts of the body, and the patient dies hectic.

After death, or amputation, the tumour is found to consist of a soft substance, somewhat like the brain, of a grayish colour, and

greasy appearance, with thin membrane-like divisions running through it, and cells, or abscesses, in different places, containing a thin bloody matter, occasionally in very considerable quantity. There does not seem uniformly to be an entire cyst, surrounding the tumour; for it very frequently dives down betwixt the muscles, or down to the bone, to which it often appears to adhere. The neighbouring muscles are of a pale colour, and lose their fibrous appearance, becoming more like liver, than muscle. The bones are always carious in the vicinity of these tumours.

The distemper is sometimes caused by external violence, though in general there is no evident cause whatever. (*Dissertations on Inflammation by J. Burns*, Vol. 2.)

Mr. Hey has given several cases of the fungus hæmatodes. If I notice the most particular circumstances, relative to one of these, it will suffice to inform the reader of the form, in which this terrible affliction has presented itself in this gentleman's practice.

A young man, aged twenty-one, two years before applying to Mr. Hey, perceived a small swelling on the inside of the right knee, not far from the patella. This tumour was moveable, and did not impede the motion of the joint: it was not discoloured, but was painful, when moved, or pressed upon. It continued in this state half a year, and then the man having hurt his knee against a stone, it gradually increased in bulk, but did not exceed the size of an egg. The skin was now discoloured with blue specks, which were taken to be veins. He could still walk with ease, and follow his business.

Two months before his admission into the Leeds Infirmary, he met with a fall, and violently bent his knee, but did not strike it against any thing. The tumour began immediately to enlarge; and within a few hours, it extended half way up the inside of his thigh. About a fortnight after this accident, the skin burst at the lowest part of the tumour, and discharged some blood. A dark-coloured fungus, about the size of a pigeon's egg, here made its appearance, and a few weeks afterward, the skin burst at another part of the large tumour, and some blood was again discharged. From the fissure arose another fungus, which had increased, in the course of the last week, to the size of a small melon, and now measured eight inches from one side of its base to the other. The base of the fungus frequently bled, especially when the man allowed his limb to hang down.

The whole tumour was now of an enormous size, being nineteen inches across, when the measure was carried over the last mentioned fungus. From its highest part in the thigh to the lowest part, just below the knee, it measured seventeen inches, without including the fungus. The base of the tumour at the knee, exclusive of that part, which ran up the thigh, measured twenty-four inches in circumference. The tumour was situated on the inner side of the limb,

and was distinctly defined. The skin covering the disease, was in some places livid, and had several fissures and small ulcerations upon it; but had not burst asunder, except in the two places above described. The tumour was soft, and gave a sensation of some contained fluid, when gently pressed with the hands alternately in opposite directions. The patient said he had walked without pain in his knee, a week before his admission into the Infirmary; and he had lost very little blood in his journey to Leeds. He complained of the greatest uneasiness in the highest part of the tumour. It had become hot and painful in the night-time, for some days past. His pulse was 114 in a minute; his tongue was clean; and his appetite had been good, till the last few days. He had never felt any pulsation in the tumour.

In a consultation it was determined, that the tumour should be laid open, by cutting off a portion of the distended integuments; and that after removing the contents, if the sac should be found in a sound state, the disease should be treated as a simple wound; but if in a morbid state, amputation of the limb should be immediately performed.

A large oval piece of the integuments being removed, the tumour was found to contain a very large quantity of a substance, not much unlike coagulated blood; but more nearly resembling the medullary part of the brain in its consistence and oily nature. It was of a variegated reddish colour, in some parts approaching to white, and as blood issued from it, Mr. Hey conceived it was organized. This mass was partly diffused through the circumjacent parts in innumerable pouches, to which it adhered, and was partly contained in a large sac of an aponeurotic texture, which was connected with the capsule of the knee-joint. There was a great and universal effusion of blood from the internal surface of the sac, and from the pouches, containing this morbid mass.

Amputation of the limb was immediately performed, on finding such to be the nature of the case. Mr. Hey, unfortunately, however, left a portion of the diseased surface behind on the inner part of the thigh, and hoping that a small narrow portion of the upper part of the sac would soon become a clean sore, and not impede the cure, he made the circular incision two inches below its higher part.

On examining the amputated limb, the vastus internus was found to be brown, and much softer than the other muscles, which were healthy. There were many small portions of blood extravasated in the substance of this muscle. The sac was formed on the aponeurotic covering of the muscle, and ended below where this aponeurosis begins to cover the capsular ligament of the knee. The two fungous substances, above described, appeared to have been only extensions of the morbid mass, where this had made its way through the sac and the integuments.

The joint of the knee, and muscles of the leg, were perfectly sound.

I need not detail all the particulars after the operation. Suffice it to say, the man suffered a great deal of constitutional disorder. After a few weeks, the granulations upon the stump became good, and the cicatrization was nearly completed at the end of the sixth week, after the amputation. At this period, the small and superficial portion of the upper part of the great sac, which Mr. Hey had unfortunately left, was now healed; but a tumour, now about four inches in length, and between two and three in breadth, had gradually risen at the lower and under part of the thigh, beneath the cicatrix. This contained a soft substance, exactly similar as far as the touch could discover, to that which had filled the large sac. This tumour became painful, and sometimes discharged a bloody serum, sometimes dark-coloured blood, through four or five small openings in the cicatrix.

Mr. Hey laid open the tumour, and removed its contents; but no advantage was gained by this proceeding. The interior surface was found to be too much diseased to produce good granulations. Blood continued to ooze out of the wound for a few days. Then the inner surface became covered with a blackish substance, which gradually extended itself, and formed a new fungus. A variety of escharotics were applied to destroy the fungus and morbid surface of the wound; but to no purpose, the growth of the fungus always exceeded the quantity destroyed. Undiluted oil of vitriol, applied freely, had very little effect.

An attempt was once more made to cut away the disease; but on examining the wound carefully, after the contained substance was removed, the muscular substance was found degenerated into a hard mass, which felt somewhat like cartilage. The adipose membrane was also diseased, and formed into large cells, which had contained the fungous substance. Hence, another amputation seemed the only resource.

After this operation, the whole surface of the stump seemed sound, except the principal artery, which was filled with a somewhat stiff matter, resembling coagulated blood, which prevented its bleeding. The inside of the vessel, on being touched with the scalpel, felt hard, and communicated a sensation, like that of scraping bone.

The man was sent home, as soon as his state would admit of it; but he died consumptive about six months afterward. Besides this instance in the thigh, Mr. Hey relates cases of fungus hæmatodes, situated in the female breast, in the leg, in the neck (extending from the jaw to the clavicle, and producing suffocation,) on the back part of the neck, on the back part of the shoulder, and at the extremity of the fore-arm, near the wrist.

"If I do not mistake, (says Mr. Hey,) this disease not unfrequently affects the globe of the eye, causing an enlargement of it, with the destruction of its internal organiza-

tion. If the eye is not extirpated, the scleritis bursts at the last, a bloody sanious matter is discharged, and the patient sinks under the complaint." (P. 283.)

Besides some cases, in similar situations, to those mentioned by Mr. Hey, one is related by Mr. Burns, in which the hip-joint was the seat of this terrible affection. After detailing the progress of the case to the poor man's death, this author states that he found on dissection, the hip-joint completely surrounded with a soft matter, resembling the brain, enclosed in thin cells, and here and there cells full of thin bloody water; the head of the thigh bone was quite carious, as was also the acetabulum. The muscles were quite pale, and almost like boiled liver, having completely lost their fibrous appearance, and muscular properties. The same sort of morbid mischief was also found within the pelvis, most of the inside of the bones, on the affected side, being quite carious. An attempt had been made, before the patient died, to tap the bladder; but the trocar had only entered a cell, filled with bloody water, and situated in a mass of the soft brain-like substance.

I have already said enough, to render the description of the dreadful nature of the fungus hæmatodes tolerably complete. Little can be said of the treatment; for we know not of one medicine, that seems to have the least power of putting a stop to the disease, and we have no reason to believe, that there is ever the smallest chance even of any spontaneous amendment, much less of such a cure.

We have seen, that when the chief part of a fungus hæmatodes is cut away, and only a small portion of its cyst is left behind, that the fungus is reproduced from this part, and soon becomes as formidable, nay more formidable, than it was before, and this notwithstanding the application of the most powerful escharotics. Neither the hydrargyrus nitratus ruber, the hydrargyrus muria- tus, the antimonium muriatum, nor the undiluted vitriolic acid, have always been able to repress the growth of such fungus. (Hey.)

There is no remedy that has the power of checking, or removing the complaint. Friction, with anodyne balsams, sometimes gives relief in the early stages; but it does not retard the progress of the disease.

In short, the only chance of cure consists in extirpating the whole of the disempowered parts, removing not only the soft, brain-like, fungous substance, but every particle of the cysts, sacs, or pouches, in which it may be contained. An operation of this kind, however, is only advisable in the early stages, while the disease is entirely local, if it ever be so, a circumstance much to be doubted; for after the neighbouring glands have become affected, the chance of recovery is almost destroyed. It is sometimes difficult, however, to persuade patients at an early period to submit to amputation, or extirpation, because the pain and inconveniences are inconsiderable; but the operation ought to be urged with all the force which a conviction of its

absolute necessity, and the fatal peril of delay, ought to inspire.

The attempts to cure the disease, by cutting it away, have been attended with such ill success, that some surgeons deem it advisable not to follow this method, but amputate the limb at once. The annexed views of the matter appear to me to be most judicious and rational. First, that if an attempt be made to cut away the tumour, and save the limb, the surgeon must be careful to remove, at the same time, a considerable quantity of the soft parts in the circumference of the swelling. Secondly, that the earlier this is done, the more likely is it to succeed. Thirdly, that, after the tumour is taken out, an attentive examination of the surface of the wound should be made, and every suspicious part or fibre be cut away. Fourthly, that, should the disease still recur, amputation ought to be instantly performed. Fifthly, that caustics should never be applied to this disease. Sixthly, that, even when one of these operations effectually extirpates the distemper of the limb, the patient's entire recovery is always rendered exceedingly uncertain, by reason of the viscera, and other invisible parts, being frequently affected, at the time of the operation, with the same sort of disease.

FUNGUS HÆMATODES OF THE TESTICLE.

3. Fungus hæmatodes of the testicle sometimes begins in its glandular part, sometimes in the epididymis. Its progress is slow, and the pain generally not severe. Nor is there, at first, any inequality or hardness of the diseased part, nor change in the scrotum. When the testicle has become exceedingly large, it feels remarkably soft and elastic, as if it contained a fluid. Hence, the case has often been mistaken for a hydrocele, and punctured with a trocar. (Wardrop; Earle in Med. Chir. Trans. Vol. 3, p. 60.) Occasionally, when the tumour is large, it is in some places hard, in others soft. The hydrocele may be known by the water beginning to collect at the bottom of the scrotum, and then ascending towards the spermatic cord, and by the swelling being circumscribed towards the abdominal ring; whereas the fungus hæmatodes begins with a gradual enlargement of the testicle itself; followed by a fulness, which extends up the spermatic cord. It is not in the slightest degree diaphanous, and is much heavier than a similar bulk of water. (Earle, *op. cit.*) As the disease advances, abscesses form, and the scrotum ulcerates; but no fungus shoots out. When the inguinal glands become contaminated, they often acquire an immense size; and when the skin over them bursts, large portions of them slough away. Fungus hæmatodes of the testicle is said to afflict young, more frequently than old subjects. On dissection, the substance of the diseased testicle is found to present a medullary, or pulpy appearance, generally of a pale brownish colour, though sometimes red. In most cases, the tunica vaginalis and tunica albuginea are

adherent together; occasionally there is fluid between them.

In an example, dissected by Mr. Lawrence, the swelling of the testicle consisted of cellular septa, filled with pulpy matter. Numerous tubercles of the disease were found in the omentum, and about the pelvis, intermixed with recently effused coagula. A mass of soft matter, equal in size to a man's head, lay on the spine, behind the aorta and vena cava, which last vessel was closed for some extent. The spermatic vessels could not be found. (See *Med. Chir. Trans.* Vol. 8, Part 1, art. 13.)

The only chance of a cure must be derived from a very early performance of castration, before the disease has extended to the inguinal glands, or far up the spermatic cord. Indeed, very little hope should be placed in the removal of the testicle; for fungus hæmatodes appears to be rather a constitutional than a local disease. Nearly every case on record has terminated fatally, and upon dissection, either the liver, the lungs, the brain, the mesenteric glands, or other internal parts, have been found affected with the same disease. In one case, dissected by Mr. Lawrence, tubercles of a similar structure to the disease in the axilla, were found in the lungs, heart, and, in short, in nearly all the thoracic and abdominal viscera, though the contents of the skull were free from disease. (See *Cases recorded by Wardrop, Earle, Lawrence, and Langstaff, in Med. Chir. Trans.* Vol. 3 and 8.)

We shall quit this subject with stating some of the principal differences between two diseases, which have been commonly confounded. A scirrhus tumour is, from its commencement, hard, firm, and incompressible, and is composed of two substances; one hardened and fibrous, the other soft and inorganic. The fibrous matter is the most abundant, consisting of septa, which are paler than the soft substance between them. A scirrhus tumour, situated in a gland, is not capable of being separated from the latter part, so much are the two structures blended. A scirrhus in another situation, sometimes condenses the surrounding cellular substance, so as to form a kind of capsule, and assume a circumscribed appearance. When a scirrhus swelling ulcerates, a thin ichor is discharged, and a good deal of the hard fibrous substance is destroyed by the ulceration; other parts become affected, and the patient dies from the increased ravages of the disease, and its irritation on the constitution. Sometimes, though not always, after a scirrhus has ulcerated, it emits a fungus of a very hard texture. Such excrescence, however, is itself at last destroyed by the ulceration. Cancerous sores, also, frequently put on, for a short time, an appearance in some places of cicatrization. On the other hand, the fungus hæmatodes, while of moderate size, is a soft elastic swelling, with an equal surface, and a deceitful feel of fluctuation. It is, in general, quite circumscribed, being included within a capsule. The substance of the tumour, instead of being for the most

part hard, consists of a soft, pulpy, medullary matter, which readily mixes with water. When ulceration occurs, the tumour is not lessened by this process, as in scirrhus; but a fungus is emitted, and the whole swelling grows with increased rapidity. Cancerous diseases are mostly met with in persons of advanced age, while fungus hæmatodes generally afflicts young subjects. (*Wardrop.*) Many dissections have now proved, that the substance of fungus hæmatodes may contain cellular septa, which include the pulpy, medullary matter.

In cases of external cancer, the viscera are not in general affected at the same time with cancerous disease; but in the majority of examples of fungus hæmatodes, this distemper is found affecting in the same subject a variety of parts. In addition to the outward tumour, we find swellings of a similar nature, perhaps, in the liver, the lungs, the mesenteric glands, or even in the brain. YET M Roux will have it, that cancer and fungus hæmatodes are the same disease; or, at least, that the latter is only a species of the former, and that in both cases the same peculiar diathesis prevails. (*Roux, Parallèle de la Chirurgie Angloise avec la Chirurgie Française.* p. 216, 217.)

See *Dissertations on Inflammation*, by J. Burns. Vol. 2. *Hey's Practical Observations in Surgery*, ed. 3. *Freer on Aneurism. Observations on Fungus Hæmatodes, or Soft Cancer*, by James Wardrop 8vo. Edin. 1809. This last publication is highly deserving of the attention of the surgical practitioner, the disease in different organs being well described, and its character discriminated from that of cancer.

A case of this disease is related in Vol. 5 of the *London Medical Journal*. It was the consequence of an attempt to cure a ganglion by means of a seton, and it proved fatal. A case is also related by Mr. Abernethy, in *Surgical Observations*, 1804, p. 99. See also a *Case of diseased Testicle, accompanied with Disease of the Lungs and Brain*, by H. Earle, in *Medico-Chirurg. Trans.* Vol. 3. p. 59, &c. in which Vol. four other cases are recorded by Mr. Lawrence. p. 71, et seq. and one by Mr. Langstaff, p. 277, which last I remember visiting in company with this gentleman and Mr. Lawrence, a short time before the patient died. See also *Langstaff's Cases and Observations in the 8th and 9th Vol. of the same work. Voyage fait à Londres en 1814, ou Parallèle de la Chirurgie Angloise avec la Chirurgie Française* p. 211, &c. On *Fungus Hæmatodes of the Eye*, there are some valuable observations in the last edition of *Scarpa's Treatise on the Diseases of that organ*. See also *Saunders on Diseases of the Eye*, and *B. Travers's Synopsis of Diseases of the Eye*, 8vo. Lond. 1820.

Respecting medullary sarcoma, which is generally considered as the same affection as fungus hæmatodes, some further observations will be delivered in the article, *Tumours*.

FURUNCULUS. (from *furo*, to rage.)

A boil, so named from the violence of the heat and inflammation attending it:

A boil is a circumscribed, very prominent, hard, deep-red, inflammatory swelling, which is exceedingly painful, and commonly terminates in a slow and imperfect suppuration. The figure of the tumour is generally that of a cone, the base of which is considerably below the surface. Upon the most elevated point of the boil, there is usually a whitish, or livid pustule, which is exquisitely sensible, and immediately beneath this is the seat of the abscess. The matter is mostly slow in forming, is seldom very abundant, and never healthy at first, being always blended with blood. The complaint is seldom attended with fever, except when the tumour is very large, situated on a sensible part, or when several of these swellings occur at the same time in different places. In the last circumstance, they often occasion in children, and even in irritable adults, restlessness, loss of appetite, spasms, &c. They rarely exceed a pigeon's egg in size, and they may originate on any part of the body.

Boils commonly arise from constitutional causes. Young persons, and especially subjects of full plethoric habits, are most subject to them. The disease is also observed to occur with most frequency in the spring. (*Lassus, Pathologie Chir. T. 1, p. 16.*) According to Richerand, the origin of boils depends upon a disordered state of the gastric organs. (*Nosographie Chir. T. 1, p. 124, edit. 2.*)

The suppuration attending a boil is never perfect, and the matter which forms is not only tinged with blood, but surrounded with a sloughy substance, which must generally be discharged before the part affected will suppurate kindly, and the disease end. Richerand compares the slough with a kind of bag, or cyst, and the whole boil with an inflamed encysted tumour.

The best plan is mostly to endeavour to make boils suppurate as freely as possible, by applying external emollient remedies. This seems to be the natural course of the disease in its progress to a cure, and, indeed, all endeavours to discuss furunculous tumours commonly fail, or succeed very imperfectly; only removing the inflammation, and leaving behind an indolent hardness, which occasions various inconveniences, according to its situation, every now and then inflames anew, and never entirely disappears, until a free suppuration has been established.

In a very few cases, perhaps, it may be proper to try to discuss boils. For this purpose, besides bleeding, gentle evacuations, and a low diet, which are requisite in this as well as other local inflammations, some prescribe as external applications honey strongly acidulated with sulphuric acid; alcohol; or camphorated oil.

But in the generality of instances, suppuration must be promoted by the use of emollient poultices. The tumour, when allowed to burst, generally does so at its apex. However, as the opening is generally long in forming, and too small to allow the sloughy cellular substance to be discharged, it is always best, as soon as matter is known to exist in the tumour, to make a free opening with a lancet, and immediately afterward to press out as much of the matter and sloughs, as can be prudently done. This having been accomplished, and the rest of the sloughs pressed out, as soon as it is practicable, healthy pus will be secreted, and the part will granulate and heal. Until the suppuration becomes of a healthy kind, and the sloughy substances are entirely discharged, an emollient linseed poultice is the best application; and when granulations begin to fill up the cavity, plain lint, and a simple pledget, are the only dressings necessary.

Where there is reason to suppose the gastric organs to be in a disordered state, an emetic should be given in the early part of the treatment, and afterward small repeated doses of any of the mild purging salts.

When an indolent hardness continues, after the inflammatory, and suppurative state of boils has been cured, the part should be rubbed with a camphorated mercurial ointment.

Besides the above acute boil, authors describe a chronic one, which is said frequently to occur, in subjects who have suffered severely from the small-pox, measles, lues venerea, scrofula, and in constitutions which have been injured by the use of mercury.

The chronic boil is commonly situated upon the extremities, is of the same size as the acute one, has a hard base, is not attended with much pain, nor any considerable discoloration of the skin, until suppuration is far advanced, and the matter is seldom quite formed before three or four weeks. This, like the former, sometimes appears in a considerable number at a time. The discharge is always thinner than good pus, and when the boil is large, and has been long in suppurating, a great deal of sloughy cellular membrane must be cast off, before the sore will heal.

The principal thing requisite in the local treatment of all furunculous, and carbuncular tumours, is to make an early free opening into them, and to press out the matter and sloughs, employing emollient poultices, till all the mortified parts are detached and removed, and afterward simple dressings. (See *Pearson's Principles of Surgery*. Richerand, *Anfangsgründe der Wundarzn.* B. 1. *Lassus, Pathologie Chir. T. 1 p. 15* Richerand, *Nosographie Chir. T. 1, p. 123, edit. 2.*

G.

GANGLION, (γάγγλιον.) In surgery, a tumour on a tendon, or aponeurosis.

A ganglion is an encysted, circumscribed, moveable swelling, commonly free from pain, causing no alteration in the colour of the skin, and formed upon tendons in different parts of the body, but most frequently upon the back of the hand, and over the wrist. A French gentleman consulted me, who had one upon the upper part of his foot, which created a great sensation of weakness in the motion of the foot, and I have taken notice, that ganglions occur particularly often just below the kneepan, in housemaids, who are in the habit of kneeling a great deal in order to scour rooms. A curious example has been lately recorded, in which a ganglion, situated exactly over the arteria radialis and the arteria superficialis volæ, was at first supposed to be an aneurism. (See *Edinb. Med. and Surg. Journ.* for April, 1821.)

These tumours, when compressed, seem to possess considerable elasticity. They often occur unpredced by any accident; frequently they are the consequence of bruises and violent sprains. They seldom attain a considerable size, and ordinarily are not painful, though every now and then there are instances to the contrary. When opened, they are found to be filled with a viscid transparent fluid, resembling white of egg. If they do not disappear of themselves, or are not cured while recent, by surgical means, they, in some cases, become so large, that they cause great inconvenience, by obstructing the motion of the part, and rendering it painful.

Discutient applications sometimes succeed in curing ganglions, and, in this country, friction with the oleum origani is a very common method. I have often seen such tumours very much lessened by this plan of treatment, but seldom cured, and no sooner has the friction been discontinued, than the fluid in the cyst has in general accumulated again.

Compression is usually more effectual than discutient liniments. Persons with ganglions, have been recommended to rub them strongly with their thumb, several times a day. After this has been repeated very often, the tumour has sometimes disappeared. But the best method is to make continual pressure on ganglions, by means of a piece of sheet-lead, bound upon the part with a bandage. There is no objection, however, to using once or twice a day, in conjunction with this treatment, frictions with the oleum origani, or camphorated mercurial ointment, provided these measures together do not seem likely to make the tumour inflame, an event, which should always be carefully avoided. Ganglions, when irritated too much, have been known to become most malignant fungous diseases.

Setons have been recommended to be in-

roduced through ganglions, with a view of curing them. This method, however, is not an eligible one; for, it is by no means free from danger, as the records of surgery fully prove. Cancerous diseases, and even a malignant fatal fungus, (*Med. Jour. Vol. 5.*) have arisen from the irritation of a seton passed through a ganglion.

Frequently, when a ganglion inflames and ulcerates, the cyst throws out a fungus, which is of a very malignant nature. Hence, the practitioner should avoid making an opening into the swelling, or doing any thing which is likely to occasion sloughing, or ulceration of the disease. Ganglions may be cured by pressure of such force as to rupture the cyst, and some authors have recommended putting the hand affected upon a table, and then striking the ganglion several times with the fist, or a mallet. The cyst of a recent ganglion may also be burst, by compressing it strongly with the thumbs, with or without the intervention of a piece of money; the fluid is effused into the adjacent cellular membrane; and, pressure being now employed, the opposite sides of the cavity become united by the adhesive inflammation, and the recurrence of the disease is prevented. (See *L'Encyclopedie Méthodique, Partie Chir. art. Ganglion*; *Lassus, Pathologie Chir. T. 1, p. 400, &c.*; *Leveillé, Nouvelle Doctrine Chir. T. 3, p. 7.*)

In almost every instance, a ganglion may be cured by pressure and friction, and if not actually cured, the disease may be rendered so bearable by these means, that few patients would choose to have the tumour cut out. Under this plan, the swelling becomes very much diminished, and should it enlarge again, the mode of relief is so simple, and the case so little troublesome, that patients generally content themselves with every now and then wearing a piece of lead on the part.

But when ganglions resist all attempts to disperse or palliate them; when they become extremely inconvenient, either by obstructing the functions of a joint, or causing pain; they should be carefully dissected out, by first making a longitudinal incision in the skin covering them, then separating the cyst on every side from the contiguous parts, and lastly cutting every particle of it off the subjacent tendon or fascia. The greatest care must be taken not to make any opening in the cyst, so as to let out its contents, and make it collapse; a circumstance, which would render the dissection of it much more difficult.

The operation being accomplished, the skin is to be brought together with sticking plaster, and a compress placed over the situation of the tumour, with a view of healing the wound and the cavity by adhesion.

When the ganglion has burst, or is ulcerated, it is best to remove the diseased skin, to-

gether with the cyst, and of course the incision must be oval or circular, as may seem most convenient. The grand object is not to allow any particle of the cyst to remain behind, as it would be very likely to throw out a fungus, and prevent a cure. In Warner's Cases of Surgery, is an account of two considerable ganglions, which this gentleman, in imitation of Celsus and Paulus Aegineta, thought it right to extirpate. These had become adherent to the tendons of the fingers. In the operation, he was obliged to cut the transverse ligament of the wrist, and the patients, who before could not shut their hands, nor close their fingers, perfectly regained the use of these parts. Mr. Gooch relates a case of the same kind, which had been occasioned by a violent bruise, three or four years before. The tumour reached from the wrist to the middle of the hand, and created a great deal of pain. Mr. Gooch extirpated it, and then restored the position of the hand, and free motion of the joint, by the use of emollient applications, and suitable pressure, made with a machine constructed for the purpose. Other cases confirming the safety of cutting out ganglions, are recorded in the *London Medical Journal*, for 1787, p. 154; by Eller, in *Mém. de l'Acad. des Sciences de Berlin*, T. 2, ann. 1746; Schmucker in *Chir. Wahrnehmungen*, 1. B. p. 332; Girard *Lupulogie*.

The ganglions, which occur just below the knee, I have seen cured by a little blister applied over them, and kept open with the savin cerate. Camphorated blisters, indeed, have been proposed as a means of dispersing other ganglions. (*Jaeger, Chir. Cautelen*, 2 B.)

For information relative to ganglions, consult *Warner's Cases in Surgery. Chirurgical Works of B. Gooch, Vol. 2, p. 376. Heister's Surgery. B. Ball's Surgery. Latta's System of Surgery. L'Encyclopédie Méthodique, Partie Chir. art. Ganglion. Richter, Anfangsgr. der Wundarzn. B. 1. Lassus, Pathologie Chir. T. 1, p. 399; Dict. des Sciences Méd. T. 17, p. 311.*

GANGRENE. (from *gano*, to feed upon.) An incipient mortification, so named from its eating away the flesh.

Authors have generally distinguished mortification into two stages; the first, or incipient one, they name *gangrene*, which is attended with a sudden diminution of pain in the place affected; a livid discolouration of the part, which from being yellowish becomes of a greenish hue; a detachment of the cuticle, under which a turbid fluid is effused; lastly, the swelling, tension, and hardness, of the previous inflammation, subside, and on touching the part, a crepitus is perceptible, owing to the generation of air in the gangrenous parts.

Such is the state, to which the term *gangrene* is applied.

When the part has become quite cold, black, fibrous, incapable of moving, and destitute of all feeling, circulation, and life; this is the second stage of mortification, termed *sphacelus*. Gangrene, however, is frequently

used synonymously with the word mortification. (See *Mortification*.)

GASTROCELE. (from *gastro*, the stomach, and *cele*, a tumour.) A hernia of the stomach.

GASTRORAPHIA, or GASTRORAPHE. (from *gastro*, the belly, and *raphi*, a suture.) A suture of the belly, or some of its contents.

Although the term *gastrophe*, in strictness of etymology, signifies no more than sewing up any wound of the belly, yet Mr. S. Sharp informs us, that in his time, the word implied, that the wound of the abdomen was complicated with another of the bowels.

The moderns, I think, seem to limit the meaning of the word to the operation of sewing up a wound in the parietes of the abdomen.

What was formerly meant by *gastrophe* could scarcely ever be practised, because the symptoms laid down for distinguishing when an intestine is wounded, do not with any certainty determine in what particular part it is wounded; which want of information, makes it absurd to open the abdomen in order to get at it. Hence, the operation of stitching the bowels can only take place when they fall out of the abdomen, and when we can see where the wound is situated. And, indeed, even in these circumstances, the employment of sutures is a practice, the propriety of which is questionable, as will be further considered in the article *Wounds*.

The circumstances, making the practice of sewing up a wounded intestine proper, are so rare, that Du Verney, who was the most eminent surgeon in the French army a great many years during the wars, and fashion of duelling, declared, that he had never had a single opportunity of practising *gastrophe*, according to the former acceptance of that word.

Gastrophe, or merely sewing up a wound of the parietes of the abdomen, may be done, as Mr. Sharp explains, with the common interrupted suture, (see *Suture*) or with the quilled one, which is better, as follows:

A ligature, capable of splitting into two, has a needle attached to each end of it. The lip of the wound is to be pierced, from within outward, about an inch from its edge. The other needle is to be passed in the same way through the opposite lip. Then the two needles are to be cut off. As many such sutures must be made, as the extent of the wound may require.

The sides of the wound are next to be brought together, and the ligatures tied, not in a bow, in the way of the interrupted suture, because the continual action of the abdominal muscles might make the ligatures cut their way through the parts. On the contrary, it is better to divide each end of the ligatures into two portions, and to tie these over a piece of bougie laid along the line at which the ligatures emerge from the flesh. This is to be done to all the ligatures on one side first. Then the wound being closed, another piece of bougie is to be placed along

the other lip of the wound, and the opposite ligatures tied over it, with sufficient tightness, to keep the sides of the wound in contact. This suture is certainly preferable to the interrupted one, because a great deal of its pressure is made on the two pieces of bougie, and of course it is less likely to cut its way out. Its operation is to be assisted with compresses laid over each side of the wound, and the uniting bandage. Every thing that puts the abdominal muscles into action, drags the suture, irritates the wound, and creates a risk of the threads cutting their way through the part, in which they are introduced; consequently, it must be avoided. In order to prevent, as much as possible, the exertion of the muscles, the bowels should be kept open with clysters. Saline draughts with opium are most likely to stop the vomiting, sometimes attendant on wounds of the abdomen, and producing very injurious effects.

In about a week, the sutures may generally be removed, and sticking plaster alone employed. As to what more relates to these particular cases, we must refer to *Wounds of the Abdomen*.

It is generally allowed, that sutures are violent means, to which we should only resort, when it is impossible to keep the lips of a wound in contact by the observance of a proper posture, and the aid of a methodical bandage. M. Pibrac believes such circumstances exceedingly uncommon, and in his excellent production, in the third volume of the *Memoirs of the Royal Academy of Surgery*, relative to the abuse of sutures, cases are related, which fully prove, that wounds of the belly readily unite by means of a suitable posture and a proper bandage, without having recourse to gastroraphe. These, however, are less decisive and convincing, (if possible to be so) than the relations of the Cæsarean operation, the extensive wound of which has oftentimes been healed by these simple means, after the failure of sutures. It is not only possible to dispense with gastroraphe in the treatment of wounds of the abdomen, it has even been manifested, that this operation has sometimes occasioned very bad symptoms.

Under certain circumstances, however, it may be essentially necessary to practise gastroraphe. For instance, were a large wound to be made across the parietes of the abdomen, a suture might become indispensably requisite to prevent a protrusion of the bowels. Yet, even in this case, the sutures should be as few in number as possible.

A bandage of the eighteen-tailed kind, might prove very useful in a longitudinal wound of the abdomen, and do away all occasion for gastroraphe. (See *Sutures*.)

We shall conclude this article with a fact, perhaps, more curious, than instructive, related by M. Bordier, of Pondicherry, in the *Journal de Médecine*, vol. 26, 538. An Indian soldier, angry with his wife, killed her, and attempted to destroy himself by giving himself a wound with a broad kind of dagger in the abdomen, so as to cause a protrusion

of the bowels. A doctor of the country, being sent for, dissected between the muscles and skin, and introduced a thin piece of lead, which kept up the bowels. The wound soon healed up, the lead having produced no inconvenience. The man was afterward hung, and M. Bordier, when the body was opened, assured himself more particularly of the fact. Indeed, numerous cases prove, that lead may lodge in the living body, without occasioning the inconvenience, which results from the presence of almost any other kind of extraneous body.

See *Le Dran, Opérations de Chirurgie. Sharp's Treatise on the Operations of Surgery. L'Encyclopedie Méthodique, Partie Chirurgicale, art. Gastroraphe; Sabatier, Médecine Opératoire, T. 1.*

GASTROTOMIA. (from γαστήρ, the belly, and τέμνω, to cut.) The operation of opening the abdomen and uterus. The Cæsarean operation.

GLAUCOMA (from γλαυκος, bluish green,) is now defined by modern surgeons to be a greenish, or gray opacity of the vitreous humour, attended with the loss, or a considerable impairment of sight. (*Weller on Diseases of the Eye, Trans. by Monteath, Vol. 2, p. 27.*) Professor Beer considers the subjects of glaucoma and the cataracta viridis, or glaucomatosa, together in the same chapter. He observes, that these diseases occur rather frequently, not only as true effects of inflammation of the eye, but sometimes quite unpreceded by this affection. Although glaucoma may continue for a long time as the only disorder, without the crystalline lens being changed in the slightest degree, yet Beer has never seen the case reversed, and the lens become altered as it does in glaucoma first, and the vitreous humour afterward. In what this author describes as gouty ophthalmia, glaucoma is said to come on with the following symptoms. The iris is not observed to expand, but rather to become contracted; the pupil is not equally dilated, but extends more towards the canthi, the iris at length becoming scarcely perceptible towards each angle of the eye, especially the outer one, and the pupil of course assuming something of the appearance which is seen in the eye of a ruminating animal. In a case, however, which I lately saw in the London Eye Infirmary under Mr. Lawrence, it was particularly remarked, that the diameter of the pupil was not greatest in the transverse direction; a circumstance, which Beer's account would lead us to expect as constant. And, it particularly merits notice, that as the iris shrinks towards the margin of the cornea, its pupillary edge is inverted towards the lens, so that its smaller circle completely disappears. In this very dilated state of the pupil, a gray greenish opacity is perceived, seeming to be very deep, and arising from a real loss of transparency in the vitreous humour. At this period, the lens evidently becomes opaque, acquiring a sea-green hue, and the cataracta viridis, or glaucomatosa, now swells and appears to project forwards into

the anterior chamber. The pain then becomes more incessant and violent; the varicose affection of the eyeball seriously increases; and the eyesight, which began hourly to diminish from the moment when the pupil was first observed to be in any degree expanded and opaque, and the iris motionless, is now so entirely destroyed, that not the slightest perception of external light remains, though the patient may vainly congratulate himself on discerning luminous appearances produced within the eye itself, in the form of a fiery, shining circle, especially when the organ is gently pressed upon. An eye in this condition (says Boyer) has really a look, as if it were dead, the cornea being as flaccid, and void of lustre, as in a corpse. Finally, when these symptoms have attained their utmost pitch, an atrophy of the eyeball follows, and the painful sensations about the organ cease. In corpulent individuals, however, they still continue with greater violence. Sooner, or later, the other eye is also either attacked with arthritic iritis, or ophthalmia, or becomes affected with glaucoma, which is ushered in by violent and incessant headach. (Beer, *Lehre von den Augenkrankheiten*, B. 1, p. 581, &c. 8vo. Wien. 1813.) According to this author, glaucoma and the green cataract, are never the consequences of any description of ophthalmia, but what he terms *arthritic*. (B. 2. p. 255, Wien. 1817.) Both these affections, after they are conjoined with a general varicose disease of the eyeball, he sets down as generally incurable. According to Weller, when the vitreous humour first begins to be muddy, the disease may sometimes be checked. (*On Diseases of the Eye*. Vol. 2. p. 29.) The means of relief, depended upon in Germany, are frictions on the eyebrow with tinc. opii croc., or liniment. ammon.; the avoidance of cold; camphorated bags of aromatic herbs applied over the eye, but the effect of which must be rather insignificant; issues; setons; rubbing the antimonial ointment over the spine, or behind the ears, &c. (Vol. cit. p. 228.)

Other authors recommend applying blisters and giving internally the extract of cicuta, calomel, and soap. (*Encyclopédie Méthodique, Partie Chir.*) The topical use of æther might be tried; but, from the history of the disease, the chances of cure must evidently be nearly hopeless. (See also *Tr. G. Benedict de Morbis humoris Vitrei*, 4to. Lips. 1809.)

GLAUCOSIS, same as Glaucoma.

GLEET. By the term *gleet*, we commonly understand a continued running, or discharge after the inflammatory symptoms of a clap for some time have ceased, unattended with pain, scalding in making water, &c. Mr. Hunter remarks, that it differs from a gonorrhœa in being uninfectious, and in the discharge consisting of globular bodies, contained in a slimy mucus, instead of serum. He says, that a gleet seems to take its rise from a habit of action, which the parts have contracted. The disease, however, sometimes stops of itself, even after every method has been ineffectually tried. This pro-

bably depends upon accidental changes in the constitution, and not at all upon the nature of the disease itself. Mr. Hunter had a suspicion, that some gleets were connected with scrofula. Certain it is, the sea-bath cures more gleets, than the common cold bath, or any other mode of bathing; and a cure may sometimes, but not always, be accomplished by an injection of diluted sea-water.

Gleets are often attended with a relaxed constitution. They also sometimes arise from other affections of the urethra, besides gonorrhœa. A stricture is almost always accompanied with a gleet; and so sometimes is disease of the prostate gland.

It is remarked by Mr. Hunter, that if a gleet does not arise from any evident cause, and cannot be supposed to be a return of a former gleet, in consequence of a gonorrhœa, either a stricture or diseased prostate gland is to be suspected: an inquiry should be made whether the stream of urine is smaller than common, whether there is any difficulty in voiding it, and whether the calls to make it are frequent. If there should be such symptom, a bougie, rather under the common size, should be introduced; and, if it passes into the bladder with tolerable ease, the disease is probably in the prostate gland, which should next be examined. (See *Urethra, Strictures of; and Prostate Gland.*)

Balsams, turpentine, and the tinctura lytta, given internally, are of service, especially in slight cases; and when they are useful, they prove so almost immediately. Hence, if they had neither lessened nor removed the gleet in five or six days, Mr. Hunter never continued them longer. The same observation applies to cubebs, so celebrated of late as a remedy for gonorrhœa and gleet, and the common dose of which is ʒij in any convenient fluid three times a day. As the discharge, when removed, is also apt to recur, such medicines should be continued for some time after the symptoms have disappeared.

When the whole constitution is weak, the cold bath, sea-bath, bark and steel, may be given. The astringent gums, and salt of steel, given as internal astringents, have little power.

With regard to local applications, the astringents, commonly used, are, the decoction of bark, sulphat of zinc, alum, and preparations of lead. The aqua vitriolica cærulea, of the London Dispensatory, diluted with eight times its quantity of water, makes a very good injection.

Irritating applications consist either of injections, or bougies, simple or medicated with irritating medicines. Violent exercise may be considered as having the same effect. Such applications should never be used till the other methods have been fully tried, and found unsuccessful. They at first increase the discharge, and, on this account, are sometimes abandoned too early. Two grains of the oxy muriate of mercury dissolved in eight ounces of water, are a very good irritating injection. In irritable habits, such an

application may do great harm, and therefore, if possible, the capability of the parts to bear its employment, should first be made out.

Bougies sometimes act violently, but Mr. Hunter thought them more efficacious, than injections. A simple unmedicated one is generally sufficient, and must be used a month or six weeks, before the cure can be depended upon. Those medicated with camphor, or turpentine, need not be used so long. The bougie should be under the common size.

Mr. Hunter has known a gleet disappear on the breaking out of two chancres on the glans. Gleets have also been cured by a blister on the under side of the urethra; and, by electricity.

In every plan of cure, rest, or quietness, is generally of great consequence; but after the failure of the usual modes, riding on horseback will sometimes immediately effect a cure.

Regularity and moderation in diet are to be observed.

Intercourse with women often causes a return, or increase of gleet; and, in such cases, it gives suspicion of a fresh infection; but the difference, between this and a fresh infection, is, that here the return is almost immediately after the connexion.

Gleets in women, are cured nearly in the same manner as those of men. Turpentine, however, have no specific effect on the vagina; and the astringent injections used may also be stronger than those intended for male patients.

See *A Treatise on the Venereal Disease*, by John Hunter, Ed. 2. Also, *Swediaur's Practical Observations on Venereal Complaints*.

GLOSSOCATOCHUS. (from *γλῶσσα*, the tongue; and *κατεχω*, to depress.) The ancient glossocatochus was a sort of forceps, one of the blades of which served to depress the tongue, while the other was applied under the chin.

GOITRE. See *Bronchocèle*.

* **GONORRHŒA.** (from *γόνυ*, the semen; and *ρεω*, to flow.) Etymologically, an involuntary discharge of the semen; but always, according to modern surgery, a discharge of a purulent infectious matter, from the urethra in the male, and from the vagina and surfaces of the labia, nymphæ, clitoris, &c. in the female subject.

Dr. Swediaur, after censuring the etymological import, as conveying an erroneous idea, says, if a Greek name is to be retained, he would call it blennorrhagia, from *βλεννα*, mucus, and *ρεω*, to flow. However, as most of the moderns consider the discharge as pus, not mucus, the etymological import of blennorrhæa is as objectional as that of gonorrhæa. In English, the disease is commonly called a *clap*, from the old French word *clapises*, which were public shops, kept and inhabited by single prostitutes, and generally confined to a particular quarter of the town, as is even now the case in several of the great towns in Italy. In German, the disorder is named a *tripper*, from dripping; and

in French, a *chaudipisse*, from the heat and scalding in making water. (*Swediaur*.)

We shall first present the reader with some of Mr. Hunter's opinions, concerning the nature of gonorrhœa, its symptoms, and treatment; and, lastly, take notice of the observations of some other writers.

When an irritating matter of any kind is applied to a secreting surface, it increases that secretion, and changes it from its natural state to some other. In the present instance, it is changed from mucus to pus.

Till about the year 1753, it was generally supposed, that the matter from the urethra, in cases of gonorrhœa, arose from ulcers in the passage; but, about that time, it was ascertained, that pus could be secreted without a breach of substance. It was first accidentally proved, by dissection, that pus could be formed in the bag of the pleura, without ulceration; and Mr. Hunter afterwards examined the urethra of malefactors and others, who were executed, or died, while known to be affected with gonorrhœa, and demonstrated, that the canal was entirely free from every appearance of ulcer.

The time when a gonorrhœa first appears, after infection, is extremely various. It generally comes on sooner than a chancre. Mr. Hunter had reason to believe, that in some instances, the disease began in a few hours; while in others, six weeks previously elapsed; but he had known it begin at all the intermediate periods. However, it was his opinion, that about six, eight, ten, or twelve days after infection, is the most common period.

The surface of the urethra is subject to inflammation and suppuration, from various other causes, besides the venereal poison; and sometimes discharges happen spontaneously, when no immediate cause can be assigned. Such may be called *simple* gonorrhœa, having nothing of the venereal infection in them.

Mr. Hunter knew of cases, in which the urethra sympathized with the cutting of a tooth, and all the symptoms of a gonorrhœa were produced. This happened several times to the same patient. The urethra is known to be sometimes the seat of the gout; and Mr. Hunter was acquainted with instances of its being the seat of rheumatism.

When a secreting surface has once received the inflammatory action, its secretions are increased and visibly altered. Also, when irritation has produced inflammation, and an ulcer in the solid parts, a secretion of matter takes place, the intention of which, in both, seems to be to wash away the irritating matter. But, in inflammations, arising from specific, or morbid poisons, the irritation cannot be thus got rid of; for, although the first irritating matter be washed away, yet, the new matter has the same quality as the original had; and therefore, upon the same principle, it would produce a perpetual source of irritations, even if the venereal inflammation, like many other specific diseases, were not what it really is,

kept up by the specific quality of the inflammation itself. This inflammation seems however, to be only capable of lasting a limited time, the symptoms, peculiar to it, vanishing of themselves by the parts becoming less and less susceptible of irritation; and the subsequent venereal matter can have no power of continuing the original irritation; for otherwise there would be no end to the disease. The time, which the susceptibility of the irritation lasts, must depend upon the difference in the constitution, and not upon any difference in the poison itself.

The venereal disease only ceases spontaneously, when it attacks a secreting surface, and produces a mere secretion of pus, without ulceration. Such were some of the sentiments of the late Mr. Hunter, who was a firm believer in the identity of the poisons of syphilis and gonorrhœa; but this idea and the hypothesis, about the impossibility of any spontaneous cure of venereal sores, are now very generally relinquished.

SYMPTOMS OF GONORRHOEA.

The first symptom is generally an itching at the orifice of the urethra, sometimes extending over the whole glans. A little fullness of the lips of the urethra, the effect of inflammation, is next observable, and soon afterward a running appears.

The itching changes into pain, more particularly at the time of voiding the urine. There is often no pain till sometime after the appearance of the discharge, and other symptoms; and in many gonorrhœas, there is hardly any pain at all, even when the discharge is very considerable. At other times, a great degree of soreness occurs long before any discharge appears. There is generally a particular fulness in the penis, and more especially in the glans. The glans has also a kind of transparency, especially near the beginning of the urethra, where the skin being distended, smooth, and red, resembles a ripe cherry. The mouth of the urethra is, in many instances, evidently excoriated. The surface of the glans itself is often in a half excoriated state, consequently very tender; and it secretes a sort of discharge. The canal of the urethra becomes narrower, which is known by the stream of urine being smaller than common. This proceeds from the fullness of the penis in general, and from the lining of the urethra being swollen, and in a spasmodic state. The fear of the patient, while voiding his urine, also disposes the urethra to contract; and the stream of urine is generally much scattered and broken, as soon as it leaves the passage. There is frequently some degree of hemorrhage from the urethra, perhaps, from the distention of the vessels, more especially when there is a chordee, or a tendency to one. Small swellings often occur, along the lower surface of the penis, in the course of the urethra. These, Mr. Hunter suspected to be enlarged glands of the passage. They occasionally suppurate, and burst outwardly, but now and then in

the urethra itself. Mr. Hunter has also suspected such tumours to be ducts, or lacunæ of the glands of the urethra distended with mucus, in consequence of the mouth of the duct being closed, in a manner similar to what happens to the duct leading from the lachrymal sac to the nose, and so as to induce inflammation, suppuration, and ulceration. Hardness and swelling may also occur in the situation of Cowper's glands, and end in considerable abscesses in the perineum. The latter tumours break either internally or externally, and sometimes in both ways, so as to produce fistulæ in perinaeo.

A soreness is often felt all along the under side of the penis, frequently extending as far as the anus. The pain is particularly great in erections; but the case differs from chordee, the penis remaining straight. In most cases of gonorrhœa, erections are frequent, and even sometimes threaten to bring on mortification: as opium is of great service, Mr. Hunter thought, that there was reason to suppose them of a spasmodic nature.

The natural slimy discharge from the glands of the urethra is first changed, from a fine transparent ropy secretion, to a watery whitish fluid; and the lubricating fluid, which the passage naturally exhales, becomes less transparent: both these secretions becoming gradually thicker, assume more and more the qualities of common pus.

The matter of gonorrhœa often changes its colour and consistence, sometimes from a white to a yellow, and often to a greenish colour. These changes depend on the increase and decrease of the inflammation, and not on the poisonous quality of the matter itself; for any irritation of these parts, equal to that produced in a gonorrhœa, will produce the same appearances.

The discharge is produced from the membrane lining the urethra, and from the lacunæ, but, in general, only for about two or three inches from the external orifice. Mr. Hunter says, seldom further, than an inch and a half, or two inches at most. This he terms the specific extent of the inflammation. Whenever he had an opportunity of examining the urethra affected with gonorrhœa, he always found the lacunæ loaded with matter, and more visible, than in the natural state. Before the time of this celebrated man, it was commonly supposed that the discharge arose from the whole surface of the urethra, and even from Cowper's glands, the prostate, and vesiculæ seminales.

But, if the matter were secreted from all these parts, the pus would collect in the bulb, as the semen does, and thence be emitted in jerks; for, nothing can be in the bulbous part of the urethra, without stimulating it to action, especially, when in a state of irritation and inflammation.

When the inflammation is violent, some of the vessels of the urethra often burst, and a discharge of blood ensues. Sometimes

such blood is only just enough to give the matter a tinge. In other instances, erections cause an extravasation, by stretching the part.

When the inflammation goes more deeply than the membranous lining, and affects the reticular membrane of the urethra, it produces in it an extravasation of coagulable lymph, the consequence of which is a chordee. (See *Chordee*.)

Mr. Hunter suspected, that the disease is communicated or creeps along from the glans to the urethra, or, at least, from the lips of the urethra to its inner surface, as it is impossible, that the infectious matter can, during coition, get as far as the disease extends. He mentions an instance, in which a gentleman, who had not cohabited with any woman for many weeks, to all appearance caught a gonorrhœa from a piece of plaster, which had adhered to his glans penis, in a necessary abroad: the infection is accounted for by supposing that some person, with a clap, had previously been to this place, and had left behind some of the discharge, and that the above gentleman had allowed his penis to remain in contact with the matter, till it had dried.

Many symptoms, depending on the sympathy of other parts with the urethra, sometimes accompany a gonorrhœa. An uneasiness, partaking of soreness and pain, and a kind of weariness, are every where felt about the pelvis. The scrotum, testicles, perinæum, anus, and hips, become disagreeably sensible to the patient, and the testicles often require to be suspended. So irritable, indeed, are they in such cases, that the least accident, or even exercise, which would have no effect of this kind at another time, will make them swell. The glands of the groin are often affected sympathetically, and even swell a little, but they do not suppurate, as they generally do when they inflame from the absorption of matter. Mr. Hunter has seen the irritation of a gonorrhœa so extensive as to affect with real pain the thighs, buttocks, and abdominal muscles. He knew one gentleman, who never had a gonorrhœa without being immediately seized with universal rheumatic pains.

When the disorder, exclusive of the affections from sympathy, is not more violent than has been described, Mr. Hunter termed it a *common, or simple venereal gonorrhœa*; but, if the patient is very susceptible of such irritation, or of any other mode of action, which may accompany the venereal, then the symptoms are in proportion more violent. In such circumstances, we sometimes find the irritation and inflammation exceed the specific distance, and extend through the whole urethra. There is often a considerable degree of pain in the perinæum; and a frequent, though not a constant symptom, is a spasmodic contraction of the acceleratores urinæ, and erectores muscles. In these cases, the inflammation is sometimes considerable, and goes deeply into the cellular membrane, but without producing any

effect except swelling. In other instances, it goes on to suppuration, often becoming one of the causes of fistulæ in perinæo. Thus, Cowper's glands may suppurate, and the irritation often extends even to the bladder itself.

When the bladder is affected, it becomes more susceptible of every kind of irritation. It will not bear the usual distention, and, therefore, the patient cannot retain his water the ordinary time; and, the moment the desire of making water takes place, he is obliged instantly to make it, with violent pain in the bladder, and still more in the glans penis, exactly similar to what happens in a fit of the stone. If the bladder be not allowed to discharge its contents immediately, the pain becomes almost intolerable; and even when the water is evacuated, there remains, for some time, a considerable pain both in the bladder and glans.

Sometimes, though rarely, when the bladder is much affected, the ureters, and even the kidneys, sympathize; and Mr. Hunter had reason for suspecting, that the irritation might be communicated to the peritonæum, by means of the vas deferens.

Mr. Hunter mentions a case, in which, while the inflammatory symptoms of a gonorrhœa were abating, an incontinence of urine came on; but, in time, got spontaneously well.

A very common symptom, attending a gonorrhœa, is a swelling of the testicle.) See *Hernia Humoralis*.)

Another occasional consequence of a gonorrhœa, is a sympathetic swelling of the inguinal glands. (See *Bubo*.)

A hard chord is sometimes observed, leading from the prepuce along the back of the penis, and often directing its course to one of the groins, and affecting the glands. At the part of the prepuce, where the chord takes its rise, there is most commonly a swelling. This sometimes happens when an excoriation and a discharge from the prepuce or glans penis exist.

From the above account, the symptoms of gonorrhœa, in different cases, seem to be subject to infinite variety. The discharge often appears without any pain; and the coming on of the pain is not at any stated time after the appearance of the discharge. There is often no pain at all, although the discharge is in considerable quantity, and of a bad appearance. The pain often goes off, while the discharge continues, and will return again. In some cases, an itching is felt for a considerable time, which is sometimes succeeded by pain; though, in many cases, it continues to the end of the disease. On the other hand, the pain is often troublesome, and considerable, even when there is little or no discharge. The neighbouring parts sympathize, as the glands of the groin, the testicle, the loins, and pubes, the upper parts of the thighs, and the abdominal muscles. Sometimes the disease appears a few hours after the application of the poison; sometimes six weeks elapse first. Lastly, it is often impossible to determine whether

the case is a venereal, or only an accidental discharge, arising from some unknown cause.

GONORRHEA IN WOMEN.

The disorder is not so easily ascertained in them as in men, because they are subject to a disorder called *fluor albus*, which resembles gonorrhœa. A discharge simply from women, is less a proof of the existence of a gonorrhœa, than even a discharge without pain in men. The kind of matter does not enable us to distinguish a gonorrhœa from a *fluor albus*; for in the latter affection, the discharge often puts on all the appearance of venereal matter. Pain is not necessarily present, and therefore forms no line of distinction. The appearance of the parts often gives us but little information; "for," says Mr. Hunter, "I have frequently examined the parts of those who confessed all the symptoms, such as increase of discharge, pain in making water, soreness in walking, or when the parts were touched, yet I could see no difference between these and sound parts. I know of no other way of judging, in cases where there are no symptoms sensible to the person herself, or where the patient has a mind to deny any uncommon symptoms, but from the circumstances preceding the discharge; such as her having been connected with men supposed to be unsound, or her being able to give the disorder to others; which last circumstance, being derived from the testimony of another person, is not always to be trusted to, for obvious reasons." But, though there may sometimes be great difficulty in forming a judgment of some of these cases, the surgeon may frequently come to a right conclusion by recollecting, as Mr. Dunn has reminded me, that, besides the difference depending on the suddenly severe symptoms of gonorrhœa, *fluor albus* may be known by the great debility; the sinking of the stomach; the weariness of the limbs; the pain of the back always increased by the erect posture; the severe headachs; the painful menstruation, together with the very gradual increase of the disease.

From the manner in which the disease is contracted, it must principally attack the vagina, a part not endowed with much sensation. In many cases, however, it produces a considerable soreness on the inside of the labia, nymphæ, clitoris, carunculæ myrtiformes, and meatus urinarius. In certain cases, these parts are so sore, that they will not bear to be touched; the person can hardly walk; the urine gives pain in its passage through the urethra; and when it comes into contact with the above-mentioned parts.

The bladder sometimes sympathizes, and even the kidneys. The mucous glands, on the inside of the labia, often swell, and sometimes suppurate, forming small abscesses, which open near the orifice of the vagina.

According to Mr. Hunter, the venereal

matter from the vagina sometimes runs down the perinæum to the anus, and produces a gonorrhœa, or chancre, in that situation. The disease in women may probably wear itself out, as in men; but it may exist in the vagina for years, if the testimony of patients can be relied on.

TREATMENT OF GONORRHEA.

As every form of the venereal disease arises from the same cause, and as we have a specific for some forms, we might expect that this would be a certain cure for every one; and, therefore, that it must be no difficult task to cure the disease, when in the form of inflammation and suppuration in the urethra. Experience teaches us, however, that the gonorrhœa is the most variable in its symptoms, while under a cure; and the most uncertain, with respect to its cure, of any forms of the venereal disease, (if it be a form of this disease at all) many cases terminating in a week, while others continue for months, under the same treatment.

The only curative object is, to destroy the disposition and specific mode of action in the solids of the parts, and as they become changed, the poisonous quality of the matter produced will also be destroyed. This effects the cure of the disease, but does not always remove the consequence.

Gonorrhœa is incapable of being continued beyond a certain time in any constitution; and, when it is violent, or of long duration, it is owing to the part being very susceptible of such irritation, and readily retaining it. As no specific remedy for gonorrhœa is known, it is fortunate that time alone will effect a cure. It is worthy of consideration, however, whether medicine can be of any service. Mr. Hunter is inclined to think it not of the least use, in nine cases out of ten. But even this would be of some consequence, if the cases capable of being benefited could be distinguished.

The means of cure generally adopted are of two kinds, internal remedies and local applications; but, whatever plan is pursued, we are always to attend more to the nature of the constitution, or to any attending disease in the parts themselves, or parts connected with them, than to the gonorrhœa itself.

When the symptoms are violent, but of the common inflammatory kind, known by the extent of the inflammation not exceeding the specific distance, the local treatment may be either irritating or soothing.

In these cases, irritating applications are less dangerous than when irritable inflammation is present, and they may alter the specific action; but, to produce this effect, their irritation must be greater than that of the original injury. The parts will afterward recover of themselves, as from any other common inflammation.

Mr. Hunter believes, however, that in the beginning, the soothing plan is the best. If the inflammation be great, and of the irrita-

ble kind, no violence is to be used, for it would only increase the symptoms; and nothing should be done that can tend to stop the discharge, as it would not put a stop to the inflammation. The constitution is to be altered, if possible, by remedies adapted to each disposition, and reducing the disease to its simple form. If the constitution cannot be altered, nothing is to be done, and the action is to be allowed to wear itself out.

When the inflammation has abated, the cure may be attempted by internal remedies or local applications, which do not operate violently, whereby the irritation might be reproduced. Gentle astringents may be applied.

But if the disease has begun mildly, an irritating injection may be used, in order quickly to get rid of the specific mode of action. This application will increase the symptoms for a time; but when it is left off they will often abate, or wholly disappear; and after such abatement, astringents may be used, the discharge being now the only thing to be removed.

When itching, pain, and other uncommon sensations are felt for some time before the discharge appears, Mr. Hunter diffidently expresses his inclination to recommend the soothing plan instead of the irritating one, in order to bring on the discharge, which is a step towards the resolution of the irritation; and he adds, that to use astringents would be bad practice, as, by retarding the discharge, they would only protract the cure. When there are strictures, or swelled testicles, astringents should not be used; for, while there is a discharge, such complaints are relieved.

Mr. Hunter thus expresses himself in regard to the effect of mercury in gonorrhœa: "I doubt very much of mercury having any specific virtue in this species of the disease; for I find that it is as soon cured without mercury as with it, &c. So little effect, indeed, has this medicine upon a gonorrhœa, that I have known a gonorrhœa take place while the patient was under a course of mercury, sufficient for the cure of a chancre. Men have been also known to contract a gonorrhœa when loaded with mercury for the cure of a lues venerea; the gonorrhœa, nevertheless, has been as difficult of cure as in ordinary cases."

Mr. Hunter does not say much in favour of evacuants, diuretics, and astringents, given internally. He allows, however, that astringents, which act specifically on the parts, as the balsams, conjoined with any other medicine, which may be thought right, may help to lessen the discharge in proportion as the inflammation abates.

Local applications may be either internal to the urethra, external to the penis, or both. Those which are applied to the urethra seem to promise most efficacy, because they come into immediate contact with the diseased parts. They may be either in a solid or fluid form. A fluid is only a very temporary application. The solid ones, or bou-

gies, may remain a long while, but in general irritate immediately, from their solidity alone: and Mr. Hunter says, the less bougies are used; when the parts are in an inflamed state, the better, though he never saw any bad effects from them, when applied with caution.

The fluid applications, or injections, in use, are innumerable; and as gonorrhœa frequently gets well with so many of various kinds, we may infer that such complaints would, in time, get well of themselves. However, there cannot be a doubt, that injections often have an immediate effect on the symptoms, and hence must have power; though the injection, which possesses the greatest power, is unknown. As injections are only temporary applications, they must be used often, especially when found useful, and not of an irritating kind.

Mr. Hunter divides injections into four kinds, the *irritating*, *sedative*, *emollient*, and *astringent*.

Irritating injections, of whatever kind, act in this disease upon the same principle; that is, by producing an irritation of another kind, which ought to be greater than the venereal; by which means the venereal is destroyed and lost, and the disease cured, although the pain and discharge may still be kept up by the injection; effects, however, which will soon go off, when the injection is laid aside. In this way bougies also perform a cure. Most of the irritating injections have an astringent effect, and prove simply astringent when mild.

Irritating injections should never be used when there is already much inflammation; especially in constitutions which are known to be incapable of bearing much irritation; nor should they be used when the inflammation has spread beyond the specific distance; nor when the testicles are tender; nor when, upon the discharge ceasing quickly, these parts have become sore; nor when the perinæum is very susceptible of inflammation, and especially if it formerly should have suppurated; nor when there is a tendency in the bladder to irritation, known by the frequency of making water.

In mild cases, and in constitutions which are not irritable, such injections often succeed, and remove the disease almost immediately. The practice, however, ought to be attempted with caution; and not, perhaps, till milder methods have failed. Two grains of the *hydrargyrus muriatus*, dissolved in eight ounces of distilled water, form a very good irritating injection; but an injection of only have this strength may be used, when it is not intended to attempt a cure so quickly. If, however, the injection, even in that proportion, gives considerable pain in its application, or occasions a great increase of pain in making water, it should be further diluted.

Sedative injections will always be of service, when the inflammation is considerable, and they are very useful in relieving the pain. Perhaps, the best sedative is opium, as well when given by the mouth, or anus,

as when applied to the part affected, in the form of an injection. But even opium will not act as a sedative in all constitutions, and parts; but on the contrary, often has opposite effects, producing great irritability. Lead may be reckoned a sedative, so far as it abates inflammation; while, at the same time, it may act as a gentle astringent. Fourteen grains of acetate of lead, in ℥viij. of distilled water, make a good sedative astringent injection.

Drinking freely of diluting liquors may, perhaps, have a sedative effect, as it in part removes some of the causes of irritation, by rendering the urine less stimulating to the bladder, when the irritation is there, and to the urethra in its passage through it. Diluting drinks may possibly lessen the susceptibility of irritation. The vegetable mucilages of certain seeds and plants, and the emollient gums, are recommended. Mr. Hunter does not entertain much opinion of their efficacy, though some of his patients told him, that they experienced less uneasiness in making water, when their drink was impregnated with mucilaginous substances.

Emollient injections are the most proper, when the inflammation is very great; and they probably act by first simply washing away the matter, and then leaving a soft application to the part, so as to be singularly serviceable, by lessening the irritating effects of the urine. Indeed, practice proves this; for a solution of gum arabic, milk and water, or sweet oil, will often lessen the pain, and other symptoms, when the more active injections have done nothing, or seemed to do harm.

The irritation at the orifice of the urethra is frequently so great, that the point of the syringe cannot be suffered to enter. In this case no injection should be used till the inflammation has abated; but in the mean while, fomentations may be employed.

Astringent injections act by lessening the discharge. They should only be used towards the latter end of the disease, when it has become mild. But if the disease should begin mildly, they may be used at the very beginning; for by gradually lessening the discharge, without increasing the inflammation, we complete the cure, and prevent a continuance of the discharge called *gleet*. They will have an irritating quality, if used strong, and hence increase the discharge, instead of lessening it. Mr. Hunter's experience did not teach him, that one astringent was much better than another. The astringent gums, as dragon's blood, the balsams, and the turpentine, dissolved in water; the juices of many vegetables, as oak bark, Peruvian bark, tormentil root, and perhaps all the metallic salts, as green, blue, and white vitriols; the salts of mercury, and also alum: probably all act much in the same way; though the mere changing of an injection is often efficacious. The local use of the nitric acid, properly diluted, has been commended by Vigaroux, Toepelmann, and others, as a safe remedy for the stoppage of

gonorrhœa. (See *Pearson on the effects of various Articles in the cure of Lues Venerea*, p. 205, Ed. 2, and *Neuere Erfahr. über zweckm. Behdl. venerisch. Schleimaussflasse*, &c. Leipzig. 1809.)

The external applications are poultices and fomentations, which can only be useful when the prepuce, glans, and orifice of the urethra, are inflamed.

Since Mr. Hunter's time, many surgeons have been in the habit of keeping the penis, in the incipient inflammatory stage of gonorrhœa, covered with linen, continually wet with the liquor plumbi acetatis dilutus; a practice which is certainly both rational and beneficial. Mr. Abernethy, in his *Lectures on Surgery*, speaks in favour of this method. And some surgeons, among whom is my intelligent correspondent, Mr. Dunn, of Scarborough, have seen great relief derived from the use of a suspensor scroti, or double handkerchief, which, combined with rest and the elevation of the penis, the last mentioned practitioner has frequently found, indeed, of more service than any thing else.

When the glands of the urethra are enlarged, mercurial ointment may be rubbed on the part; but this will probably be of most service after the inflammation has subsided.

TREATMENT OF GONORRHOEA IN WOMEN.

This is nearly the same as that of the disease in men, but is more simple. When the disorder is in the vagina, injections are best; and after their use, the external parts should be well washed. It is almost impossible for the patient to throw an injection into the urethra, when it is affected. The same injections are proper as for men; but they may be made doubly strong. When the glands of the vagina suppurate, and form abscesses, these should be opened, and dressed; but the practice of smearing the parts with mercurial ointment, as advised by Mr. Hunter, is now entirely abandoned.

CONSTITUTIONAL TREATMENT OF GONORRHOEA.

In many strong plethoric constitutions, the symptoms are violent, and there is a great tendency to inflammatory fever. In such instances opiate clysters, though at first productive of relief, sometimes occasion in the end fever, and consequently aggravate all the symptoms. In these cases, the balsam of capivi also sometimes increases the inflammatory symptoms. In a constitution of this kind, the treatment consists chiefly in evacuations, the best of which are bleeding, and gentle purging. The patient must live sparingly, and above all, use little exercise.

In a weak and irritable constitution, the symptoms are frequently violent, the inflammation extending beyond the specific distance, running along the urethra, and even affecting the bladder. Here the indication is to strengthen; and according to Mr. Hun-

ter, bark alone has been known to effect a cure. All evacuations are hurtful.

A fever has been known to stop the discharge, relieve the pain in making water, and finally cure the disease. On other occasions, Mr. Hunter has seen all the symptoms of gonorrhœa cease on the accession of a fever, and return when the fever was subdued. In other examples, a gonorrhœa mild at first, has been rendered severe by the coming on of a fever, and upon its subsidence, the gonorrhœa has ceased. Although a fever does not always cure a gonorrhœa, yet, as it may do so, nothing should be done while it lasts. If the local complaint should continue after the fever is gone, it is to be treated according to symptoms.

A gonorrhœa may be considerably affected by the patient's manner of living, and by other diseases attacking the constitution. Most things which hurry or increase the circulation, aggravate the symptoms; such as violent exercise, drinking strong liquors, eating strong indigestible food, some kinds of which act specifically on the urethra, so as to increase the symptoms more than simply heating the body would do; such as pepper, spices, and spirits.

In cases which have begun mildly, in which the inflammation is only slight, or in others in which the violent symptoms have subsided, such medicines as have a tendency to lessen the discharge may be given, together with the local remedies before mentioned. Turpentine is the most efficacious, particularly the balsam of copaiva, and cubebs. (See *Edin. Med. and Surgical Journ.* for January 1818. and for the same month, 1819; also *H. Jeffrey's Pract. Obs. on Cubebs*; *Svo. Lond.* 1821.) Of the latter medicine Zij may be given thrice in the 24 hours; but with respect to these and all other remedies, which act upon the disease through the medium of the urine, if they succeed at all, it is always within a week, or ten days, from the beginning of their use; and therefore, if no amendment takes place in this time, they should not be continued. Cantharides, the salts of lead and copper, and alum, have also been recommended.

Mr. Hunter advises small doses of mercury, in consequence of the possibility of absorption, and with a view of preventing lues venerea.

TREATMENT OF OCCASIONAL SYMPTOMS OF GONORRHEA.

Bleeding from the Urethra is sometimes relieved by the balsam capivi. Mr. Hunter did not find astringent injections of use.

Painful erections are greatly prevented by taking twenty drops of tinctura opii at bedtime. Cicuta has also some power in this way; and many surgeons, among whom is Mr. Dunn, of Scarborough, have a favourable opinion of camphorated poultices, and of the internal exhibition of camphor; a medicine, which I ought to have mentioned in former editions, as a common means of lessening the pain and inconvenience of

erections in the inflammatory stage of gonorrhœa.

Chordee. See this word.

Bladder affected. Opiate clysters, the warm bath, and bleeding, if the patient is of full habit, are proper. Leeches may be applied to the perinæum. When this affection lasts a considerable time, and is not mitigated by common methods, Mr. Hunter advises trying an opiate plaster on the pubes, or the loins, where the nerves of the bladder originate; or a small blister on the perinæum. In another place he mentions bark, cicuta, sea air, and sea bathing, among the proper means.

Swelled Testicles. See *Hernia Humoralis*.

For a more full account of Gonorrhœa, according to the above doctrines, see a *Treatise on the Venereal Disease*, by John Hunter, from page 29 to 90.

ON THE QUESTION, WHETHER GONORRHEA IS REALLY A FORM OF THE VENEREAL DISEASE.

The foregoing remarks, and others in Mr. Hunter's work, would lead one to believe that the poison of gonorrhœa and the venereal virus are the same. Here it is my duty impartially to state the arguments, which have been urged for, and against, this important doctrine.

Mr. Hunter assures us, that he has seen all the symptoms of lues venerea originating from gonorrhœa only; that he had even produced venereal chancres by inoculating with the matter of gonorrhœa; and that he afterward repeated these experiments in a manner in which he could not be deceived. (*P.* 293, *et seq.*)

Mr. Hunter's experiments, it is true, have been repeated with a different result; but, as a late writer has remarked, can we wonder at this, when we consider from how many causes gonorrhœa may arise, and how impossible it is to distinguish the venereal from any other? (*Obs. on Morbid Poisons*, by J. Adams, *M. D.* p. 91, *Ed.* 2.)

Another argument, adduced by Hunter, in favour of the poisons of gonorrhœa and chancre being the same, is the probability, that the Otaheiteans had the venereal disease propagated to them by European sailors, who were affected with gonorrhœa; for these can hardly be supposed to have had a chancre during a voyage of five months, without the penis being destroyed.

It is impossible, however, to say what time may elapse, between the application of the venereal poison to the penis, and the commencement of the ulceration. Therefore, Bougainville's sailors, alluded to by Mr. Hunter, might have contracted the infection at Rio-de-la-Plata; but actual ulcers on the penis might not have formed till about five months afterward, when the ship arrived at Otaheite.

In attempting to explain, why a gonorrhœa, and a chancre do not equally produce lues venerea, and why the medicine which almost universally cures chancre, has less

effect on gonorrhœa, a modern advocate for Mr. Hunter's doctrine says, that we must take into consideration, that the seat of the two diseases is different; that the same cause may produce different effects upon different parts; that the same poison, when mixed with different fluids, may be more or less violent in its operation; and that there may be greater or less attraction of certain fluids to a part, according to its nature and composition. (*Inquiry into some effects of the Venereal Poison by S. Sawrey, 1802, p. 4.*) Mr. Sawrey very truly remarks, p. 6, that if the gonorrhœal matter has clearly and decidedly produced chancre, or contaminated the system in any one instance, the question is determined. It could in no instance produce these effects, unless it had the power of doing so. This writer brings forward some cases to prove, that the poison of gonorrhœa may produce gonorrhœa, or chancre; but the limits of this work only afford room to observe, that these instances are by no means decisive of the point, because some objections may be urged against them, as indeed, Mr. Sawrey himself allows. That Mr. Hunter's cases are inconclusive, I have particularly endeavoured to explain in the *First Lines of the Practice of Surgery, Vol. 1, Ed. 4*, to which I must refer my readers.

Why does not gonorrhœa commonly produce ulceration in the urethra? Mr. Sawrey tries to solve this question, by saying, that the product of the venereal inflammation, the diseased contents of the small arteries of the urethra, are thrown out of these open-mouthed vessels into this canal, without any breach of their texture, which otherwise would be a necessary consequence.

Why does not gonorrhœa equally contaminate the system as chancre? In gonorrhœa, says Mr. Sawrey, the discharge is very plentiful; it is not, in general, attended with ulceration; the poison is much more diluted, and mixed with a mucous and puriform fluid. It is deposited in the urethra, and its lacunæ, where little or no pressure is applied, and it finds easy egress out of the canal. In chancre there is breach of substance, the poison is not much diluted, &c.

Why does not chancre generally, in the same person, produce gonorrhœa, and gonorrhœa produce chancre? Mr. Sawrey, in answer, expresses his belief, that these incidents are not very infrequent. He says, he has known persons having a chancre, which continued for months, become affected, after that time, with a clap, without any further exposure. His opinion is, that the matter of the chancre had insinuated itself into the urethra, and produced the disease; though, he confesses, many would explain the circumstance, by supposing that the chancre and gonorrhœa were both communicated at the same time by two different poisons.

Mr. Hunter remarks, that the presence of one disease renders the adjacent parts less susceptible of its influence.

Mr. Sawrey concludes his second chapter with inclining to the idea, that the matter of gonorrhœa is not strictly pus, but of a

more mucous nature than that of a chancre. However, when he mentions chymical attractions, as drawing the poison from mucus to the urethra, and from pus to the dry parts, in order to explain the last of the above questions, every sober reader must feel sorry, that a work, which contains some really sensible observations, should comprehend this most unfortunate one.

Mr. Whately has also written, in support of the opinion, that the matter of gonorrhœa and that of chancre are the same. (See *Whately on Gonorrhœa Virulenta*.)

Another defender of this side of the question is Dr. Swediaur, who endeavours to prove the fallacy of the following positions:—1. *That the poison which produces the clap, does never, like that of chancres, produce any venereal symptoms in the mass or lues itself.* 2. *That the poison of the clap never produces chancres, and that the poison of chancres never produces a clap.* 3. *That mercury never contributes to, nor accelerates the cure of a clap; but that, on the contrary, every blennorrhagia may be certainly cured without mercury, and without any danger of leaving a lues behind.*

His arguments run thus:—the reason why claps do not, like chancres, constantly produce the lues, is, that most of them excite only a superficial inflammation in the membrane of the urethra, without any ulceration. Hence, absorption cannot easily take place, the poison being out of the course of the circulation. But he has seen claps with an ulcer in the urethra, followed by the most unequivocal symptoms of lues itself. He mentions the urethra being defended with a large quantity of mucus, as the thing impeding the common formation of ulcers, which do occasionally occur when the mucus is not secreted as usual, or is washed away. He asserts, that in many cases, where he had occasion to examine both parties, he was convinced that the chancres were communicated by a person affected with a simple gonorrhœa; and, *vice versa*, that a virulent clap had been the consequence of an infection from a person having merely chancres. He says, that if a patient, with a venereal running, does not take care to keep the prepuce and glans perfectly clean, chancres will very often be produced. He owns a great many claps are cured without mercury; yet, repeated experience has shown him, a cure cannot always be thus accomplished. Mild cases, without ulcer or excoriation in the urethra, may certainly be radically cured without a grain of mercury; and though mercury should be given, it would not have the least effect: not because the disease does not proceed from the venereal poison, but because out of the course of the circulation. He contends, that the topical use of mercury in injections, acts usefully even in these cases. But, when a clap is joined with ulceration in the urethra, it is always cured more safely and expeditiously with mercury, and is frequently incurable without it. A lues also follows cases attended with ulcers in the urethra.

He allows that all claps are not venereal. (See *Pract. Obs. on Venereal Complaints*, by J. Swediaur.)

One argument urged against the identity of gonorrhœal and chancreous virus, is, that gonorrhœa was not described as a symptom, till nearly half a century after the other symptoms of the venereal disease were known. Fallopius is among the first who observed gonorrhœa, as a symptom of the venereal disease. "If, however," says Dr. Adams, "venereal gonorrhœa was unnoticed till about fifty years after the other forms of the disease were described, what does this prove, but that contagious gonorrhœa was so common, as to be disregarded as a symptom of the new complaint? Can there be a doubt, from the caution given by Moses, that gonorrhœa was considered as contagious in his days? During the classical age, we find inconveniences of the urinary passages were imputed to incontinence; and the police of several states, before the siege of Naples, made laws for preserving the health of such as would content themselves with public stews, instead of disturbing the piece of families.

This is enough to lessen our surprise, that gonorrhœa should be unnoticed for some time after the appearance of the venereal disease. But, so far is it from proving that the two contagions are different, that the fairest inference we can draw is in favour of their identity. For, if by this time the venereal disease began to be so far understood, that secondary symptoms were found the consequence of primary ones in the genitals, it is most probable that the first suspicion of venereal gonorrhœa arose from the occurrence of such secondary appearances, where no other primary symptoms could be traced." (*Adams on Morbid Poisons*, p. 95, Ed. 2.)

In relating the arguments maintained by the best modern writers, to repel the attacks made on the doctrine, that gonorrhœa and chancre arise from the same poison, we have been compelled to disclose the chief grounds on which the assailants venture to entertain a contrary theory.

The sentiments of Mr. B. Bell are quite at variance with those of Hunter, Sawrey, Swediaur, Adams, &c.; but my limits will only allow me just to enumerate a few of his leading arguments.

If the matter of gonorrhœa, and that of chancre, were of the same nature, we must admit, that a person with a chancre only, can communicate to another, not only every symptom of pox, but of gonorrhœa; and that another with gonorrhœa only, can give to all with whom he may have connexion, chancres, with their various consequences. This ought indeed to be a very frequent occurrence; whereas, all allow that it is even in appearance very rare.

On the supposition of the matter of gonorrhœa and lues venerea being the same, the latter ought to be a much more frequent occurrence than the former, from the greater ease with which the matter of infection

must, in every instance, be applied to those parts on which it can produce chancres, than that of the urethra, where instead of chancre or ulceration, it almost always excites gonorrhœa. It is difficult to conceive how the matter by which the disease is communicated, should find access to the urethra; while all the external parts of the penis, particularly the glans, must be easily and universally exposed to it; and yet gonorrhœa is a much more frequent disease than pox. Cases of gonorrhœa are in proportion to those of chancre, according to Mr. B. Bell's experience, as three to one. It is obvious that the very reverse should happen, if the two diseases were produced by the same kind of matter.

I need not adduce other arguments, as the reader must be already acquainted with any worth knowing, from what is said in the previous part of this article.

The grand practical consideration, depending on the possibility of the venereal disease arising from gonorrhœa, is whether mercurials should not be exhibited, in all cases, with a view of preventing such a consequence.

Waiving on my own part, all attempts to decide the point, whether the matter of a chancre, and that of one species of gonorrhœa, are of the same nature, I shall merely content myself with stating, that as far as my observation and inquiries extend, the majority of the best practitioners of the present day consider the exhibition of mercury unnecessary, and consequently improper in all cases of gonorrhœa. This fact almost amounts to a proof, that if venereal symptoms do ever follow a clap, they are so rare, and, I may add, always so imputable to other causes, that the employment of mercury, as a preventive, would, upon the whole, do more injury than benefit to mankind; and this even admitting (what, in my mind, has never been unequivocally proved) that the matter of gonorrhœa is really capable, in a very few instances, of giving rise to the venereal disease.

The reader must weigh the different arguments himself. Some of Mr. B. Bell's reasoning is certainly untenable, as Mr. Sawrey has clearly shown; but the latter, also, is not invulnerable in many points, which he strives to defend.

The reader is referred for further information, to J. F. Staedel, *de Gonorrhœa Virulenta*, 4to. Argent, 1695: W. Cockburn, *The Symptoms, Nature, Cause, and Cure of a Gonorrhœa*, 8vo. Lond. 1728. J. Andree, *An Essay on the Theory and Cure of the Venereal Gonorrhœa, and the Diseases which happen in consequence of that Disorder*, 8vo. Lond. 1777. J. Nevill, *A Description of the Venereal Gonorrhœa*, 8vo. Lond. 1754. J. Norman, *Method of Curing the Virulent Stillicidium, or Gonorrhœa, with an Account of the efficacy of Plummer's Alterative Pills*, 8vo. J. Clubbe, *An Essay on the Gonorrhœa Virulenta, in which the different opinions respecting the Treatment of the Disease are carefully examined*, &c. 8vo. Lond. 1786. S. F. Simmons, *Obs.*

on the Cure of Gonorrhœa, 8vo. Lond. 1780. W. Thomas, *An Essay on Gonorrhœa, with some Obs. on the Use of Opium in the Cure of that Disease*, 8vo. Lond. 1780. *A Treatise on the Venereal Disease*, by J. Hunter, 1788. W. Rowley, *The most cogent reasons, why Astringent Injections, &c. should be banished*, 8vo. Lond. 1800. J. H. G. Schlegel, *Versuch einer Geschichte des Streites über die Identität des Venus und Trippergiftes*, 12mo. Jenæ, 1796. *Whately on the Gonorrhœa Virulenta*, 8vo. Lond. 1801. *Pract. Obs. on Venereal Complaints*, by F. Swediaur, M. D. Edit. 3. *An Inquiry into some of the effects of the Venereal Poison*, by S. Sawrey, 1802. *Obs. on Morbid Poisons*, by J. Adams, M. D. Edit. 2, 1807. J. C. Jacobs, *Démonstration de l'Identité des Virus de la Verole et de la Gonorrhée*, 8vo. Bruxelles, 1811. J. F. Hernandez, *Essai Analytique sur la nonidentité des Virus Gonorrhœique et syphilitique*, 8vo. Toulon, 1812. R. Carmichael, *Essays on the Venereal Diseases, which have been confounded with Syphilis, &c.* 4to. Lond. 1814, and his *Obs. on the Symptoms and Specific Distinctions of Venereal Diseases*, 8vo. Lond. 1818.

GORGET. An instrument, used in the operation of lithotomy, for the purpose of cutting the prostate gland and neck of the bladder, so as to enable the operator to introduce the forceps and extract the stone. It is, in fact, a sort of knife, at the end of which is a beak, that fits the groove of the staff, and admits of being pushed along it into the bladder.

Besides cutting gorgets, constructed for the preceding design, there are also blunt ones, intended to be introduced into the wound, when their concavity serves as a guide for the forceps into the bladder.

GRANULATIONS. The little, grain-like, fleshy-bodies, which form on the surfaces of ulcers, and suppurating wounds, and serve both for filling up the cavities, and bringing nearer together and uniting their sides.

We must here consider the operations of nature, in bringing parts as nearly as possible to their original state, whose disposition, action, and structure, have been altered by accident, or disease. Having formed pus, she immediately sets about forming new matter, upon surfaces in which there has been a breach of continuity. This process is called *granulating*, or *incarnation*; and the substance formed is called *granulations*.

Granulations are an accretion of animal matter upon the wounded or exposed surface; they are formed by an exudation of the coagulating lymph from the vessels; into which new substance, both the old vessels very probably extend, and in which new ones are formed. Hence, granulations are extremely vascular; indeed, more so than almost any other animal substance. "That this is the case (says Mr. Hunter) is seen in sores every day. I have often been able to trace the growth and vascularity of this new substance. I have seen upon a sore a white substance exactly similar, in every visible respect, to coagulating lymph. I have not attempted to wipe it off, and the next day of

dressings I have found this very substance vascular; for, by wiping, or touching it with a probe, it has bled freely. I have observed that the same appearance on the surface of a bone that has been laid bare. I once scraped off some of the external surface of a bone of the foot to see if the surface would granulate. I remarked the following day, that the surface of the bone was covered with a whitish substance, having a tinge of blue. When I passed my probe into it, I did not feel the bone bare, but only its resistance. I conceived this substance to be coagulable lymph thrown out from inflammation, and that it would be forced off when suppuration came on; but, on the succeeding day, I found it vascular, and appearing like healthy granulations." The vessels in granulations pass from the original parts to their basis, and thence towards their external surface, in tolerably regular parallel lines. The surface of this new substance has the same disposition to secrete pus, as the parts which produced it. The surfaces of granulations are very convex, the reverse of ulceration, having a great many small points, or eminences, so as to appear rough. The smaller such points are, the more healthy are the granulations. The colour of healthy granulations is a deep florid red. When livid, they are unhealthy, and have only a languid circulation. Healthy granulations, on an exposed or flat surface, rise nearly even with the surface of the surrounding skin, and often a little higher; but when they exceed this, and take on a growing disposition, they are unhealthy, become soft, spongy, and without any disposition to form skin. Healthy granulations are always prone to unite to each other, so as to be the means of uniting parts.

Granulations are not easily formed on the side of an abscess, nearest the surface of the body.

They are not endowed with the same powers as parts originally formed. Hence, they more readily ulcerate and mortify. The curious mode in which granulations contract, when sores are healing, and even for some time after they are healed, we have explained in the article *Cicatrization*. See *A Treatise on the Blood, Inflammation, &c.* by John Hunter, p. 473, et seq. 1794.)

It is a question, whether granulations can ever be formed without suppuration? Mr. Hunter seems inclined to think that they may occasionally be produced without it, and he supports his opinion by the relation of the dissection of a fractured limb, in which he observed a substance resembling granulations. Dr. John Thomson, on the other hand, declares, that he has never seen any thing which he could regard as an example of a granulation, and still less of a granulating surface, where pus was not formed. (See *Lectures on Inflammation*, p. 408.)

The exact process, by which the blood-vessels, nerves, and absorbents of granulations are formed, is still among the secrets of nature. The observations of Mr. Hunter on the subject amount only to conjecture. "The growth of nerves, and their develop-

ment in new formed flesh, or granulations (says Dr. J. Thomson,) is a subject of equal curiosity with the growth of blood-vessels in the same structure. Their existence in granulations is proved by the pain, which is felt on our pinching, rubbing, or wiping the surface of a sore. Even the granulations which arise from the surface of bone, are sensible, though we are not very able to prove the sensibility of the larger branches of nerves, from which the newly formed, and sensible nerves and filaments in the granulation, are immediately derived. All the difficulties which I formerly mentioned to you, as occurring in the explanation, of the manner in which coagulable lymph, or granulations, are penetrated with blood-vessels, present themselves the moment we begin to reflect on the manner in which the same granulations are provided with nerves, and these difficulties are still increased, when we reflect that the same granulations are in the course of a few hours provided, not only with blood-vessels and nerves, but also with a system of absorbents. The existence of absorbents in granulations is proved, not only by the changes of bulk, which we see them daily undergo, becoming gradually, in the healthy state, smaller, firmer, and more compact, but also, by the frequent disappearance, in whole, or in part, of a granulating surface by the process of ulcerative absorption." (See Thomson's *Lectures on Inflammation*, p. 419.) Every young dresser of sores at an hospital, who has been too lavish of the red precipitate ointment, must have learned from experience, that mercury may be absorbed from the surface of ulcers, and bring on an unwished for salivation of the patient.

GUAIAUCUM. Many writers of the sixteenth century, contended, that guaiacum was a true specific for the venereal disease; and the celebrated Boerhaave, in the eighteenth, maintained the same opinion. Mr. Pearson mentions, that when he was first entrusted with the care of the Lock Hospital, in 1781, Mr. Brownfield and Mr. Williams were in the habit of reposing great confidence in the efficacy of a decoction of guaiacum wood. This was administered to such patients as had already employed the usual quantity of mercury; but who complained of nocturnal pains, or had gummata, nodes, ozæna, and such other effects of the venereal virus, connected with secondary symptoms, as did not yield to a course of mercurial frictions. The diet consisted of raisins, and hard biscuit; from two to four pints of the decoction were taken every day; the hot bath was used twice a week; and a dose of antimonial wine and laudanum or Dover's powder, was commonly taken every evening. Constant confinement to bed was not deemed necessary; neither was exposure to the vapour of burning spirit, with a view of exciting perspiration, often practised; as only a moist state of the skin was desired. This treatment was sometimes of singular advantage to those whose health had sustained injury from the disease, long confinement, and mercury. The strength increased;

bad ulcers healed; exfoliations were completed; and these anomalous symptoms, which would have been exasperated by mercury, soon yielded to guaiacum.

Besides such cases, in which the good effects of guaiacum caused it to be erroneously regarded as a specific for the lues venerea, the medicine was also formerly given by some, on the first attack of the venereal disease. The disorder being thus benefited, a radical cure was considered to be accomplished; and, though frequent relapses followed, yet, as these partly yielded to the same remedy, its reputation was still kept up. Many diseases, also, which got well, were probably not really venereal cases. Mr. Pearson seems to allow, that in syphilitic affections, it may, indeed, operate like a true antidote, suspending for a time, the progress of certain venereal symptoms, and removing other appearances altogether; but, he observes, that experience has evinced, that the unsubdued virus yet remains active in the constitution.

Mr. Pearson has found guaiacum of little use in pains of the bones, except when it proved sudorific; but that it was then inferior to antimony, or ammonia. When the constitution has been impaired by mercury, and long confinement, a thickened state of the ligaments, or periosteum, or foul ulcers, still remaining, Mr. Pearson says, these effects will often subside, during the exhibition of the decoction. He says, it will often suspend, for a short time, the progress of certain secondary symptoms of the lues venerea; for instance, ulcers of the tonsils, venereal eruptions, and even nodes. Mr. Pearson, however, never knew one instance in which guaiacum eradicated the virus; and he contends, that, its being conjoined with mercury, neither increases the virtue of this mineral, lessens its bad effects, nor diminishes the necessity of giving a certain quantity of it. Mr. Pearson remarks, that he has seen guaiacum produce good effects in many patients having cutaneous diseases, the ozæna, and scrofulous affections of the membranes and ligaments. (See Pearson on the Effects of Various Articles in the Cure of Lues Venerea, edit. 2. 1807.)

GUMMA, a soft tumour, so named from the resemblance of its contents to gum.

GUNSHOT WOUNDS receive their name from the manner in which they are produced, being generally caused by hard, obtuse, metallic bodies, projected from cannons, muskets, or some other species of fire-arm. With such injuries, it is also usual to comprehend a variety of dreadful accidents arising from the explosion of shells, or the violence with which pieces of stones from ramparts, or splinters of wood on board of ship, are driven about. Gunshot wounds are the most considerable of the contused kind; and what is to be said of them, will apply more or less, to all contused wounds, according to the degree of contusion. They are particularly characterized by, what the French surgeons are fond of calling, a *disorganization* of their surface. The excessive contusion, and

violence, observable in gunshot wounds, depend upon the rapidity, with which the bodies occasioning them, are propelled. The parts touched by the ball, are frequently converted into a blackish slough, the colour of which made our ancestors suppose, that bodies, projected by gunpowder, became heated, and actually burnt the flesh, with which they came into contact. But reason and experience have now proved, that whatever may be the rapidity of a projectile, it never acquires in its passage any perceptible heat. Indeed, a modern writer asserts, that such a degree of heat as would be requisite to make a ball burn parts in its passage, would really melt it. (*Richerand, Nosographie Chir. T. 1, p. 217, edit. 2.*) In general, gunshot wounds do not bleed much, unless large blood-vessels be injured; their circumference is often livid; and the shock that attends their infliction, or the injury done to the nerves, may occasion in the limb, or part, a kind of torpor, sometimes extending itself to the whole system.

However, as Dr. Hennen most truly observes, "the effects of a gunshot wound differ so materially in different men, and the appearances are so various, according to the nature of the part wounded, and the greater or lesser force with which it has been struck, that no invariable train of symptoms can be laid down as its necessary concomitants. If a musket or pistol ball has struck a fleshy part, without injuring any material blood-vessel, we see a hole about the size of or smaller than the bullet itself, with a more or less discoloured lip, forced inwards; and if it has passed through the parts, we find an everted edge, and a more ragged and larger orifice at the point of its exit. The hemorrhage is in this case very slight, and the pain inconsiderable, inasmuch that, in many instances, the wounded man is not aware of his having received any injury. If, however, the ball has torn a large vessel, or nerve, the hemorrhage will generally be profuse, or the pain of the wound severe, and the power of the part lost. Some men will have a limb carried off, or shattered to pieces by a cannon ball, without exhibiting the slightest symptoms of mental or corporeal agitation; nay, even without being conscious of the occurrence; and when they are, they will coolly argue on the probable result of the injury; while a deadly paleness, instant vomiting, profuse perspiration, and universal tremor, will seize another on the receipt of a slight flesh wound. This tremor, which has been so much talked of, and which, to an inexperienced eye, is really terrifying, is soon relieved by a mouthful of wine, or spirits, or by an opiate; but, above all, by the tenderness and sympathizing manner of the surgeon, and his assurance of the patient's safety." (*Principles of Mil. Surgery, p. 33, Ed. 2.*)

On the other hand, it is correctly noticed by Mr. Guthrie, that the continuance of the constitutional alarm, or shock, ought to excite great suspicion of serious injury; and, when wounds have been received in

such situations, or bear such appearances as render it doubtful whether any parts of vital importance have been injured or not, the manner in which the constitutional perturbation lasts may be assumed as evidence of the fact, when other symptoms, more indicative of the injury, are wanting; and, under all such circumstances, a very cautious prognosis should be delivered. (*On Gunshot Wounds, p. 11, Ed. 2.*)

Respecting the general character of gunshot wounds not to bleed much, unless large vessels be injured, it is a fact which necessarily depends upon the degree of contusion usually attending these injuries. But it is also true, as the preceding author has stated, that, although some gunshot wounds bleed but little at first, there is in the greater number of cases more or less of blood; and in wounds of vascular parts, like the face and neck, the quantity lost is often considerable, though the main arterial branches may not be injured. (*Op. cit. p. 5. Ed. 2.*)

In gunshot wounds, another circumstance is observed, which is often remarked in other cases, viz. when a large artery is partially divided, the bleeding is more profuse and dangerous than when the vessel is completely severed, and the hemorrhage, if not repressed by a tourniquet or other means, will often continue until the patient dies. Thus, Mr. Guthrie speaks of three cases, in which life was lost from wounds of the femoral, humeral, and carotid arteries, no effectual means of stopping the hemorrhage having been adopted. (*P. 8.*)

Until Ambroise Paré introduced more correct theories upon the subject of gunshot wounds, ideas the most false, and errors highly prejudicial, prevailed, both in their history and treatment, and particularly respecting what have been falsely named wind contusions. Cannon balls and bullets sometimes produce dreadful degrees of injury, without occasioning any breach of continuity in the integuments. This observation is so strictly true, that the muscles and bones may actually be crushed and broken to atoms, without the skin being at all wounded. Such cases were for a long while imputed to the violent motion, supposed to be communicated to the air by the ball itself. It was imagined, that this elastic fluid, being rapidly displaced by the shock of the projectile, was capable of making such pressure on surrounding bodies as to destroy their texture. But how could this violent pressure originate in the midst of the open and unbounded air? If this theory were true, the effect in question would constantly happen whenever a ball passes near any part of the body. The contrary, however, is so much the case, that pieces of soldiers' and seamen's hats, of their feathers, clothes, and even hair, are shot away in every battle, without any other mischief being done.

In consequence of the manner in which such injuries of the soft parts, and even of the bones, unattended with any breach in the skin, have been supposed to be produ-

ced, they have been erroneously termed *wind-contusions*. In fact, these cases are now universally acknowledged by all the most accurate observers, never to proceed from the cause to which formerly they were always ascribed.

The air does not move with the same rapidity as the ball, but its motion is less in proportion as it is a more subtle matter, and must be too feeble to account for such a violent degree of injury. The air, to which the ball must really communicate the greatest motion, is what is directly before it, and this never bruises the part untouched by the ball itself. It is only the air, situated laterally to the shot, that is imagined to do injury, and it cannot be greatly agitated. The violent consequences of sudden explosions, and the effects produced on the organ of hearing, by strong commotions of the air, prove nothing relative to the point in question. Lastly, experience does not confirm the reality of such wind-contusions; for cannon balls often tear off whole members, without the adjacent parts being in the least injured. (See *Le Vacher, in Mémoires de l'Acad. de Chir.* T. 4, p. 22.)

An eminent professor, who visited the continent for the purpose of seeing the wounded after the battle of Waterloo, fully coincides with M. Le Vacher and all the moderns upon this subject. "We saw, and were informed of many instances, in which cannon-balls had passed quite close to all the parts of the body, and had removed portions of the clothes and accoutrements, without producing the slightest injury of any kind. In other instances, portions of the body itself were removed by cannon-balls, without the contiguous parts having been much injured. In one case, the point of the nose was carried off by a cannon-ball, without respiration being at all affected; and in another very remarkable case, the external part of the ear was shot away, without even the power of hearing being sensibly impaired. (See *Report of Observations made in the British Military Hospitals in Belgium, &c. by John Thomson, p. 33, Edinb. 1816.*)

I could cite many cases, which I have seen myself, in proof of the truth of Le Vacher's opinions; but the point is now so universally admitted, that I shall merely add one observation that occurred to the notice of many as well as myself. At the bombardment of the French fleet in the basin of Antwerp, early in 1814, a cannon shot shattered the legs of two officers so badly, that the limbs were amputated. These gentlemen were walking at the moment of the accident in the village of Merksam, taking hold of the arm of my friend, assistant surgeon Stobo, of the 37th regiment, who was in the middle. Now the ball, which produced the injury, did not the slightest harm to the latter gentleman, although it must have passed as close as possible to his lower extremities, and most probably between them.

Neither can what have been improperly called *wind-contusions*, be attributed to an

electrical shock on the parts, in consequence of the ball being rendered electrical by friction in the calibre of the gun, and giving off the electricity as it passes by: (*Vide Plenck's Sammlungen, 1 Theil. p. 99.*) for metals never acquire this property from friction.

The mischief imputed to the air is occasioned by the ball itself. Its producing a violent contusion, without tearing the skin, and entering the limb, is to be ascribed to the oblique direction in which it strikes the part, or, in other instances, to the feebleness with which the ball strikes the surface of the body, in consequence of its having lost the greater part of its momentum, and acting principally by its weight; being, in short, what is called a spent ball. Daily observation evinces, that balls, which strike a surface obliquely, do not penetrate, but are reflected; though they may be impelled with the greatest force, and the body struck may be as soft and yielding as water. This alteration in the course of the ball not only happens on the surface of the human body, but also in the substance of a limb which it has entered. Thus, a bone, a tendon, &c. may change the direction of a ball which touches them at all obliquely. Hence, it is manifest how it happens, that the track of a gunshot wound is not always straight, and how balls sometimes run under the integuments nearly all round the body or limb.

The causes of several of the peculiarities attending gunshot wounds, are to be sought among the laws by which moving bodies are governed, and by which the mechanical effect of a ball, propelled against any part of the body, must therefore be determined. The form, the momentum, and the direction of the shot that is received; the position, and the variety of structure, or, in other words, the variety of density and powers of resistance, in the part receiving it, must always be considered, in order to account satisfactorily for the effects which it produces. And though, says Mr. Chevalier, in many cases, a mathematical explication of the course of a ball cannot be given, this arises entirely from the want of data, the laws of matter being fixed and immutable. But, when the data are known, as, for instance, the velocity and direction of the shot, the position of the patient, or of the wounded part at the time of the accident, and the structure of the parts penetrated, a much more probable conjecture of the course of the ball may generally be formed, than if these circumstances had not been regarded.

On the principle of the density and resistance of parts, attempts have been made to explain the reason of the concussion, or shock, which is given, in many instances to the whole system, by gunshot wounds, and which is represented by writers on this subject to be often attended with grave and even alarming effects, extending not only over the injured part, but affecting the system at large. Thus, a shot striking against a tendon, or a bone, in one of the extremities, will produce a greater concussion than

if it struck only against softer parts. A shot, striking a muscle in action, will produce more concussion than if it struck against the same part of the same muscle at rest; and a shot, striking the head, or wounding the liver, lungs, or intestinal canal, will generally bring on instantaneous derangement of the whole system, with which the functions of these parts are so closely connected. (See a *Treatise on Gunshot Wounds*, by T. Chevalier, Part 1, sect. 7.)

Respecting the mechanical effects of the concussion, I am disposed to think with Mr. Guthrie, that they have been rather exaggerated, and that in reality a more accurate explanation of the disorder of the system might be derived from other considerations; "a shot through the lungs (says he) will cause an instantaneous derangement of the whole system, but the resistance afforded by the part, has little to do with it: it is the lesion of the organic functions, intimately connected with life, that is the cause of the derangement. In the same manner, I do not conceive, that the general affection of the system depends alone on the shock received, but on the effect the injury committed has on the nervous system." (*On Gunshot Wounds*, p. 26, Ed. 2.)

A ball, when it strikes a part of the body, may cause four kinds of injury. 1. It may only occasion a contusion, without penetrating the part, on account of its being too much spent, or of the oblique way in which it strikes the surface of the body. 2. It may enter and lodge in the substance of a part; in which case the wound has only one aperture. 3. It may pierce through and through; and then there are two openings, one at the entrance, the other at the exit of the ball. The circumference of the aperture, where the shot entered, is usually depressed; that of the opening, from which it came out, elevated. At the entrance, there is commonly more contusion, than at the exit of the ball. The former opening is generally narrower; the latter wider, and more irregular, especially when the round smooth figure of the ball has been changed by its having struck a bone. 4. A cannon-ball may tear off a whole limb. (*Richter, Anfangsg. der Wundarzn. B. 1.*)

Gunshot wounds differ very much, according to the kind of body projected, its velocity, and the nature and peculiarities of the parts injured. The projected bodies are mostly bullets, sometimes cannon-balls, sometimes pieces of broken shells, and very often, on board of ship, splinters of wood. On account of the contusion, which the parts suffer, from the violent passage of the ball through them, there is most commonly a part of the solids surrounding the wound deadened, which is afterward thrown off in the form of a slough, and which prevents such wounds from healing by the first intention, and makes most of them necessarily suppurate. This does not take place equally in every gunshot wound, nor in every part of the same wound; and the difference commonly arises from the variety in the velocity of the body project-

ed; for, where the ball has passed with little velocity, which is sometimes the case at their entrance, but still more frequent at the part last wounded, the injury may often be healed by the first intention. (*J. Hunter, p. 523.*)

Until I had the pleasure of reading the last edition of a valuable book on gunshot wounds, I did not know, that at the present day, any surgeons entertained the idea, that the whole track of every gunshot wound must unavoidably suppurate, and slough; (*Guthrie on Gunshot Wounds, p. 62, Ed. 2.*) but if this sentiment prevail, it is plain from the preceding statement, that the authority of Mr. Hunter cannot be adduced in its support. At the same time, I believe, that few army surgeons will be inclined to question the correctness of Mr. Hunter's account of the general occurrence of a degree of sloughing, or of the deadened state of a part of the surface of a wound, particularly in the vicinity of the entrance of the ball, or the truth of his observations about the common necessity of the separation of such slough before the parts will heal; and whether the dead part be thrown off in small fragments with the matter, or larger portions, the fact is still correct.

Foreign bodies more frequently lodge in gunshot wounds than any others, and are commonly of three kinds. 1. Pieces of clothing, or other things, which the ball forced before it into the limb. 2. The ball itself. 3. Loose splinters of bone. It is only when the ball strikes the naked flesh, touches no bone, and goes quite through the part, that the wound can be free from extraneous matter. Foreign bodies are the cause of numerous unfavourable symptoms, by irritating sensible parts, and exciting pain, inflammation, convulsions, hemorrhage, long suppurations, &c.; and the more uneven, pointed, and hard they are, the more likely they are to produce these evils. Hence spiculæ of bone are always the most to be dreaded. (*Richter.*)

The great obliquity and length of the fissures produced in the cylindrical bones by musket-balls, are such as are not remarked in any common cases of fracture. When I was with the army in Holland, in the year 1814, I had in my hospital at Oudenbosch, several fatal compound fractures of the thigh, caused by gunshot violence. The fissures in some of these examples were found to extend two-thirds of the length of the bone. This fact is noticed by Mr. Guthrie: "the fractures extend far above and below the immediate part struck by the ball, and as far as depends upon my information from the examination of limbs that were amputated further downwards than upwards; so that from a fracture in the middle of the thigh, I have often seen fissures extend into the condyles, and cause ulceration of the cartilages of the knee joint," &c. (*On Gunshot Wounds, p. 190.*)

When a ball strikes a bone, the concussion produced is another occasion of bad symptoms, to be added to those already

mentioned. When slight, its effects are confined to the injured limb; but sometimes they extend to the neighbouring joints, in which they produce inflammation and abscesses.

It is commonly stated in surgical books, that when a cannon-ball tears off a limb, it produces a violent concussion of the whole body, and a general derangement of all its functions. This, however, is by no means always true. I saw some years ago, in London, a young sailor, whose arm had been completely torn off at the shoulder, by a cannon-ball from one of the forts at Gaudaloupe, in March 1808; he suffered no dreadful concussion of his body, nor were his senses at all impaired. This case was very remarkable, as the scapula was so shattered, that Mr. Cumhings, of Antigua, was under the necessity of removing the whole of it. The patient recovered in two months. From the account, which I heard, I do not believe, that the axillary artery bled immediately after the accident. The young man was shown to the gentlemen of St. Bartholomew's Hospital, quite well.

There is one curious effect, which occasionally follows gunshot wounds; but I do not pretend to understand the rationale of it: viz inflammation and suppuration of some internal viscus, especially of the liver. Several such cases are related in the *Mem. de l'Acad. de Chirurgie*, and according to Mr. Guthrie, many patients in the peninsula, who had undergone secondary amputations for gunshot injuries, were destroyed by affections of their lungs, liver, &c. (*On Gunshot Wounds of the Extremities*, p. 74, et seq.)

From the circumstance of the inner surface of gunshot wounds being often more or less deadened, they are late in inflaming. But when a ball has fractured a bone, which fracture has occasioned great injury of the soft parts, independently of that caused immediately by the ball itself, the inflammation will come on as quickly, as in cases of compound fracture; because the deadened part bears no proportion to the laceration or wound in general. (*J. Hunter*, p. 524.)

From the same circumstance of a part being often deadened, gunshot wounds frequently cannot be completely understood in the first instance, for in many cases, it is at first impossible to know what parts are killed, whether bone, tendon, or soft part. Nor can this be ascertained till the slough separates, which often makes the wound much more complicated than was previously imagined. For, very often, some viscus, or a part of some viscus, or a part of some large artery, or even a bone, has been killed by the violence. If a piece of intestine has been killed, the contents of the bowel will begin to come through the wound when the slough separates. If a portion of a large blood-vessel be killed, a profuse, and even fatal hemorrhage may come on, when the slough is detached, although no material quantity of blood may have been previously lost. (See *Hunter*, p. 525.) Thus, several days after the receipt of the wound, and

when all danger from inflammation is over, a bleeding per anum, occasioned by the separation of a slough from some internal vessel, may destroy the patient, as happened in a very interesting case reported by Mr. Guthrie. (*P. 13, Ed. 2.*) A soldier of the 2d battalion of the 44th regiment was shot in the ham at the assault of Bergen-op-zoom in 1814. There was no hemorrhage for ten days; but at the end of this period, the popliteal artery gave way, and I was obliged to take up the femoral artery, by which means the bleeding was effectually stopped, and the man recovered. This fact, and another related by Baron Boyer, (*Annuaire Med. Chir. de Paris*, p. 364, 4to Paris, 1819,) prove, that a ligature on the femoral artery may sufficiently check the current of blood through the popliteal artery to put a stop to hemorrhage from a wound in it; and though such practice in some other cases of wounded arteries is inefficient, on account of the facility with which the blood passes through the anastomoses into the part of those vessels below the ligature, (See *Arteries*.) its general success, in gunshot wounds of the ham, would be of infinite advantage, not only on account of the difficulties of taking up the popliteal artery itself, (difficulties ably depicted by Scarpa,) but because laying open the inflamed and diseased parts would frequently have a fatal termination. At the same time, I would have surgeons always recollect the important difference between an aneurismal and a wounded artery; for, as in the first case, there is no outlet for the blood, the transmission of this fluid into the part of the vessel below the ligature may keep up a pulsation in the tumour, and retard the cure of the disease, but is attended with no risk of hemorrhage: while the same free passage of the blood into the wounded portion of a large artery, would give rise to dangerous bleeding; and hence the general necessity of applying two ligatures, one immediately above, the other below, the aperture in such a vessel. A single ligature on the brachial artery fails, as I had an opportunity of seeing in Holland in a case of gunshot wound, where either that vessel, or the commencement of the radial, or ulnar, gave way, on the loosening of the sloughs, and as there was considerable swelling, oedema, and inflammation of the limb, threatening gangrene, the surgeon, under whose care the patient was, deemed it right to perform amputation.

I should be sorry, if these observations were to hold out any general encouragement of the wrong and dangerous practice of applying only one ligature above a wound in a large artery, or in any recent case of false diffused aneurism. The remarks, delivered above, were chiefly intended to refer to gunshot wounds of the ham, with injury of the popliteal artery, and hemorrhage first breaking out several days after the receipt of the wound, when all the parts behind the knee are enormously swelled, and in a state of inflammation and suppuration. Here the hope of avoiding any additional violence,

or injury of the diseased parts behind the knee, may be a good reason for taking the chance of stopping the bleeding by a ligature applied to the femoral artery; a reason, however, which would not exist in the case of a recent wound of the popliteal artery with a knife. At the same time, I believe, this means of checking the current of blood will not always suffice, and that occasionally either the dangerous expedient of cutting open the swelling in this diseased state of the ham, and of applying a ligature above and below the aperture in the popliteal artery must unavoidably be encountered, or amputation performed. Why the first plan has answered in some cases, and not in others, may depend upon the size and condition of the wound, or opening in the artery, and in examples of sloughing, upon the degree in which the tube of the vessel may have been closed by the adhesive inflammation. Some wrong conclusions may also have been made respecting the trunk of the vessel being wounded, or opened, while in fact only a branch of it was concerned. As a qualification, therefore, of any inferences, which might be drawn from the partial success of applying one ligature only in cases of large wounded arteries, I annex the following remarks, published some little time ago in an ably conducted periodical work. "It appears to us, that some of the cases, which M. Roux has given, as the most favourable for the operation of Hunter, are the least so; for example, he performs it in the cases where aneurism has formed in consequence of the wound of the artery. In support of this, he gives two cases, where, upon the authority of M. Mirault, of Angers, the ligature of the artery above the wound was sufficient. In one case, the humeral was the artery said to be wounded; in the other, the femoral. We doubt if the femoral were really wounded in this case; for, on referring to the report, we do not find sufficient evidence of that fact; it appears more probable, that a branch only was wounded. We have seen the operation of Hunter performed unsuccessfully in two cases of aneurism, consequent upon a wound of the artery; and we have seen the preparation of a third case, where the same operation was performed and failed; that is to say, the inoculations were so free, that hemorrhage returned by the lower orifice. In the first case, the popliteal artery was ruptured by a spicula of bone. The second was a wound of the femoral artery by an iron spike: and the third was a stab of the femoral artery by a knife. In each of these cases, the hemorrhage returned by the lower part of the artery. There is in the *Bulletins de la Faculté de Médecine*, for 1818, a case by the same Mirault, of an aneurism of the femoral artery, in consequence of a wound some considerable time before. Mirault operated according to the method of Hunter, that is, he tied the artery above the aneurism. The sac burst, two hemorrhages ensued, and the second carried off the patient on the fifteenth day after the operation.

(N.B. Here, however, it is proper to remark, that, if the case had been a true aneurism, and the sac had burst, while a stream of blood was yet passing through it, as always happens for some days after the ligature of the artery, above the tumour, hemorrhage would have occurred just as it did in the present case of false aneurism. The premature bursting of the tumour, in fact, converted the case directly into one, analogous to a wounded artery, the blood having a passage outwards.) It is rather curious that the first case, which occurred to M. Roux, after his return from England, should be one, which forms a strong argument against performing the operation of Hunter for a wounded artery. "The case, here alluded to, was that of a wound of the femoral artery with a knife, a little below the middle of the thigh, where M. Roux immediately cut down to the vessel some way above the injury, and there applied two ligatures, besides a reserve ligature. On the tenth day, hemorrhage came on, when the tightening of the latter ligature having no effect, M. Roux exposed the artery higher up, and applied fresh ligatures immediately below the profunda. This stopped the hemorrhage from the upper end of the vessel, but on the following morning fresh bleeding took place from the lower end of the artery, and it became necessary to lay open the artery below the wound, and also apply ligatures there. No further bleeding took place. (See *Quarterly Journ. of Foreign Medicine*, Vol. 1, p. 14, 8vo. Lond. 1819.) The tenor of the preceding observations is unquestionably correct, inasmuch as wounded arteries and recent false diffused aneurisms are concerned; but with respect to cases of false circumscribed aneurisms, of some standing, without any external opening in the skin, they are examples, to which the same principles should not always be applied, which are so properly recommended to be observed with regard to the other instances. In these latter, the blood may either escape from the lower end of the vessel out of the external wound, or into the cellular membrane after the ligature is applied above the aperture in the artery; but, no sooner is a false aneurism encysted, than these dangers are prevented.

When the ball moves with little velocity, the mischief is generally less; the bones are not so likely to be fractured; the parts are less deadened, &c. However, when the velocity is just great enough to splinter a bone, which is touched, the splintering is generally more extensive, than if the impetus of the ball had been much greater, in which case, a piece is more likely to be taken out. When the ball moves slowly, it is more likely to be turned by any resistance it may encounter in its passage through parts, and hence the wound is more apt to take a winding course.

When a ball enters a part with great velocity, but is almost spent, before it comes out again, in consequence of the resistance it has met with, there may be a good deal of sloughing about the entrance, and little or

none about the exit, owing to the different degrees of celerity with which the ball traversed the parts. (See *Hunter*.)

Gunshot wounds may have either one, or two apertures, according as the ball has lodged, or passed quite through the part. In some cases, the openings are diametrically opposite each other; in others they are not so, the direction of the ball having been changed by the resistance, which it has met from a bone, cartilage, tendon, &c. Thus a ball has been known to enter just on the inside of the ankle, and come out near the knee, to enter the fore-head, and come out at the temple, &c. (*Richerand, Nosographie Chir. T. 1, p. 219, Edit. 2.*) Dr. Hennen mentions an instance, in which a ball entered near the pomum Adami, and after running completely round the neck, was found in the very orifice, at which it had entered. "This circuitous route is a very frequent occurrence, particularly when balls strike the ribs, or abdominal muscles; for they are turned from the direct line by a very slight resistance indeed, although they will at times run along a continued surface, as the length of a bone, along a muscle, or a fascia, to a very extraordinary distance." Dr. Hennen refers to cases, in which the ball traversed almost the whole extent of the body and extremities. "In one instance, which occurred in a soldier, with his arm extended in the act of endeavouring to climb up a scaling ladder, a ball, which entered about the centre of the humerus, passed along the limb, and over the posterior part of the thorax, coursed among the abdominal muscles, dipped deep through the glutæi, and presented on the forepart of the opposite thigh, about midway down. In another case, a ball, which struck the breast of a man standing erect in the ranks, lodged in the scrotum." (*Principles of Military Surgery, p. 34, Ed. 2.*) The opening, where the ball enters, is always smaller than that from which it escapes, and its margin is forced inwards, while the circumference of the other aperture is quite prominent. The contusion and injury, which the parts suffer, are also greatest about the entrance of the ball, owing to the more considerable impetus, with which it moves. The yellowish livid hue, around gunshot wounds, is a sort of ecchymosis, or extravasation of blood. The injured member is often benumbed and stupefied, and, when mortification occurs, it spreads with extraordinary rapidity. When the whole constitution is thrown into this kind of torpor, the most fatal consequences are to be apprehended. "C'est dans cet état, (says Richerand) que mourut le chevauléger, dont parle Quesnay; l'état d'hébétude était tel, que cet individu à qui l'on proposa l'amputation de la jambe, répondit que ce n'était pas son affaire." (*Nosographie Chirurg. Tom. 1, p. 221, Edit. 2.*) In cases of gunshot wounds, sudden shiverings, syncope, and nervous symptoms, are not unfrequent. Such occurrences, with other bad effects, made the ancients suspect, that something poisonous was carried into

the wound; an opinion, which is now well known to be erroneous.

When there is only one opening, we may infer, that the wound contains a foreign body. An exception to this observation occurs, however, when a ball instead of tearing the clothes, or linen, carries a portion of them, in the form of a sac, into the wound, and when such portion of the clothes is withdrawn, the ball falls out, and if this circumstance be not noticed, the presence of a single opening may lead to the idea, that the bullet is lodged in the part. An instance of this kind is cited by Paré for the purpose of refuting the former notion, that the ball burst the parts. A case, in which a piece of a shirt was carried in this manner four inches into the flesh is mentioned by Mr Guthrie. (*P. 20, Ed. 2.*) It is possible also for a ball to be stopped immediately it has entered the body, and then to be ejected by the elasticity of the parts, against which it strikes, as the cartilages of the ribs. (*Guthrie, p. 19, Ed. 2.*) When there are two apertures made by one shot, the ball has escaped; but pieces of the clothes, &c. may still be lodged in the part. Care must be taken, however, not to confound with these cases others, in which the plurality of openings has been made by different balls.

As a modern writer has accurately explained: "It is no uncommon thing for a ball in striking against the sharp edge of a bone, to be split into two pieces, each of which takes a different direction. Sometimes it happens, that one of the pieces remains in the place, which it struck, while the other continues its course through the body. Of a ball, split by the edge of the patella, I have known one half pass through at the moment of the injury, and the other remain in the joint for months, without its presence there being suspected. In the same manner, I have known a ball divided by striking against the spine of the scapula, and one portion of it pass directly through the chest, from the point of impulse, while the other moved along the integuments, till it reached the elbow-joint. But, the most frequent examples of the division of bullets, which we had occasion to see, were those which were produced by balls striking against the spherical surface of the cranium. It sometimes happens, that one portion of the ball enters the cranium, while the other either remains without, or passes over its external surface. Not unfrequently, in injuries of the cranium, the balls are lodged between its two tables, in some instances much flattened, and altered in their shape, and, in other instances, without their form being changed." From these facts, it must be evident, that even when a gunshot wound has two orifices, the surgeon cannot be certain, that the bullet has not been divided, and that no portion is lodged, unless the entire ball itself happen to be found. (See *Thomson's Reports of Obs. in Military Hospitals in Belgium, p. 37, &c.*)

As the ends of the torn vessels are contused and compressed, gunshot wounds have

less propensity to bleed at first seriously, than most other wounds, unless vessels of importance happen to be injured. There may even be little hemorrhage at first though a considerable artery be so hurt, that it afterward sloughs, and a dangerous, or a fatal bleeding arises. Thus, (as I have already mentioned) in one of my own patients, who had received a musket ball through the ham, the popliteal artery gave way about ten days after the injury, and compelled me to take up the femoral artery; and, in the Elizabeth Hospitals at Brussels, among the patients under the care of my friend Mr. Collier and myself, about a week after the battle of Waterloo, the cases of hemorrhage, on the loosening of the sloughs, were tolerably numerous not at all coinciding with a recent calculation, that the proportion of such examples, requiring the ligation of arteries, is only three or four in 1000. (*Guthrie on Gunshot Wounds*, p. 8; Ed. 2.) In Holland, the truth of Mr. Hunter's observation upon this point appeared to me to be equally confirmed.

It has long been known, that a limb may be torn, or shot off, even near to the trunk of the body, and hardly any hemorrhage arise. We had numerous proofs of this fact after the battle of Waterloo. I had under my care a man of the rifle brigade, whose arm was shattered to pieces as high as the shoulder, yet there was no hemorrhage. I amputated the thigh of a Dutch soldier, whose leg had been completely shot off by a cannon ball; but there was no hemorrhage before the operation. At Merksam, in 1814, I saw a case, in which the greater part of the clavicle, scapula, and many adjacent parts, had been carried away by a cannon-ball; and yet no bleeding of consequence occurred.

Sometimes, after these violent injuries, the large arteries do not bleed in amputation. "We saw a man, (says Dr. Thomson) whose leg had been shot off by a cannon-ball; in amputating his limb above the knee, the arteries of the thigh were not perceived to bleed; nor did any of them afterward require to be tied. A case, similar to this, also presented itself, in which the arm had been shot away close to the shoulder-joint."

Sometimes the contusion, produced by a cannon-ball, or the passage of a bullet in the vicinity of a large artery, seems to cause a laceration of the inner coat of the vessel, and a subsequent obliteration of its cavity by the effusion of coagulable lymph. Facts, in proof of this statement, are recorded by Dr. Thomson. (See *Reports of Observ. in the Military Hospitals in Belgium*, p. 34, 35.)

Angular uneven bodies, such as pieces of iron, cut lead, &c. produce far more dangerous wounds, than round even bodies, like leaden bullets. Wounds occasioned by a small shot, are frequently more perilous, than others produced by larger balls; because their track is so narrow, that it cannot be traced, nor consequently the extraneous body itself extracted. Such a shot often in-

jures a viscus, when there is not the smallest external symptom of the occurrence. Sometimes a great part of the danger, also, arises from the number of the shots which have entered.

TREATMENT OF GUNSHOT WOUNDS.

The first thing in the treatment of a gunshot wound in one of the extremities, is to determine, whether it is most advisable to amputate the limb immediately, or to undertake the cure of the wound. When a bone, especially at a joint, is very much shattered; when the fleshy parts, particularly the great blood-vessels and nerves, are lacerated; when the whole limb has suffered a violent concussion, and is cold and senseless; there is no hope of preserving it. In this case, it is the surgeon's duty to amputate at once, and not to delay till inflammation, fever, and a tendency to mortification come on. But, besides this violent degree of injury, in which the propriety of amputation is obvious, there are several lower degrees, in which it is often a difficult thing to decide whether the operation is necessary or not. Here the surgeon must look not only to the injury, but also to the patient's constitution, and even to external circumstances, such as the possibility or impossibility of procuring good accommodation, rest, attendance, and pure air. But it is impossible to determine the necessity of amputation by general rules. In every individual case, the surgeon must consider maturely the particular circumstances, before he ventures to decide. The grounds against the operation are; the pain which it causes at a period when the whole system is disordered by a terrible injury; the privation of a limb; and frequent examples, in which nature, aided by judicious surgery, repairs the most horrible wounds. The following are the reasons in favour of the operation. By it the patient gets rid of a dreadful contused wound, which threatens the greatest peril, and which is exchanged, as it were, for a simple incised one. The pain of amputation is not of more moment than the pain which the requisite incisions, and the extraction of foreign bodies, would cause in case the operation were abandoned. In cases of gunshot wounds, the loss of the limb cannot be taken into the account for, the surgeon only undertakes the operation where he designs to save the patient's life by that privation, and anticipates that the part itself cannot be preserved. Even, if he should deprive the patient of a limb, that perhaps, might have been preserved, there is this atonement, that he can furnish him with an artificial leg, which often proves far more serviceable, than the lost limb would have proved, had it been preserved. Should the operation be fixed on, it is to be immediately performed above the wound. (*Richter, Anfangsgr. der Wundarzn. B. 1.*)

When amputation is deemed unnecessary, the surgeon, according to precepts formerly in vogue, is to dilate the wound by one or more incisions. Many of he

missile weapons employed by the ancients, when received into the body, required incisions, before they could be extracted; and this was the case, not only with regard to darts and arrows, but also with regard to bits of stone, pieces of iron, and leaden bullets, which were thrown by means of slings. Celsus mentions the necessity of enlarging the orifices, through which these bodies had entered, and may therefore be justly regarded, as the first who recommended the practice of dilatation in the treatment of wounds made by leaden bullets. (*Thomson's Reports of Obs. in the Military Hospitals of Belgium*, p. 39.)

Such a dilatation has been said to have numerous advantages; to facilitate the extraction of foreign bodies; to occasion a topical bleeding, and afford an outlet for the extravasated fluid in the circumference of the wound; to convert the fistulous form of the track of the ball into an open wound; and, lastly, to divide ligamentous aponeuroses, which otherwise might give rise to spasmodic and other untoward symptoms.

More modern experience proves, however, (*Hunter*, p. 529.) that the utility of such incisions has been overrated; that they generally increase the inflammation, which, in these cases, is so much to be apprehended; that wounds which are not dilated, commonly heal more speedily than others which are; and that there are only a few cases, in which incisions are beneficial. In fact, as Dr. Hennen has correctly stated, the knife is now rarely, if ever employed in the first instance by English surgeons, except for the purpose of extracting balls, splinters of bone, and other extraneous bodies, or for facilitating the application of ligatures to bleeding vessels. (See *Principles of Military Surgery*, p. 49, Ed. 2.)

The injuries, arising from the practice of indiscriminate dilatation, (says Dr. Thomson) were very early pointed out by Botallus; and it is singular, how much the opinions of this author, with regard to this point in military surgery, coincide with those of Mr. Hunter. (*Op. cit.* p. 40.)

The cases of gunshot wounds are various. Sometimes the track of the ball lies superficially under the skin, and only has one opening. When it lies in soft parts, and the ball has neither touched a bone, nor a considerable blood-vessel, all incisions are useless, let the wound have one or two apertures. Though dilating the wound has been practised with a view of giving vent to matter, eschars, and foreign bodies, and even its whole track has been laid open, when superficial; yet, experience proves the inutility of such steps. As, when a ball has passed with great force, there is often a real loss of substance in the skin, a portion of which is driven inward before the ball, it follows, that the opening of a gunshot wound must be more capacious than that of a punctured one. By the separation of sloughs, the wound becomes still more dilated, so that not only matter, but foreign bodies, which approach the skin, easily find an exit. Be-

sides incisions commonly close again very soon, and in a few days, the wound falls into the same state, as if no dilatation at all had been made. (*Hunter*, p. 532.)

Ligamentous fibres, and fasciæ, are often situated about the orifice of a gunshot wound, and some surgeons have made it a rule always to divide them completely, lest, when the wound inflames, the tension and confinement of parts should cause violent spasms and nervous symptoms; and afterward impede the discharge of matter and foreign bodies. When they obviously have the first effects, the propriety of dividing them cannot be doubted; but, with a mere expectation of the other evils, I consider the practice injudicious. Here, as Mr. Hunter wisely remarks, the method would be very good, if tension and inflammation were not a consequence of wounds, or, if it could be proved, that the effects of dilating a part, that is already wounded, were different from those of the first wound; but the employment of the knife, being only an extension of the first mischief, must be contradictory to common sense, and common observation. (*On Gunshot Wounds*, p. 534, &c.)

The extraction of foreign bodies ranks as one of the most urgent motives for the dilatation of the wound, and no doubt it is right to remove, at first, as many of them as possible. Their lodgment irritates the wound, causes violent nervous and inflammatory symptoms, and copious suppuration; circumstances, which the timely extraction of them may prevent. Yet, let it be remembered, that the extraction of foreign bodies is frequently attended with immense irritation, and that, while they lie too firmly fixed in parts, it is often a matter of impossibility. After the sloughs have separated, and the wound has become widened, suppuration frequently does not prevail long before the extraneous substances become loose, spontaneously approach the skin, and easily admit of removal without any dilatation.

Hence, it is generally prudent to extract, at first, only such foreign bodies, as are near the external opening, quite loose, and removeable without much irritation; or such as press on parts of importance, and, thereby excite dangerous symptoms. The surgeon should avoid interfering with those which are deeply and firmly lodged in the wound. He should await suppuration, and the detachment of sloughs, and when the foreign bodies become moveable and apparent, he should extract them, with or without an incision; as circumstances may demand. The examination of the wound ought to be made as much as possible with the finger, which irritates less, and feels more distinctly than a probe. A great variety of instruments have been devised, either for ascertaining the position of balls, and other foreign bodies in gunshot wounds, or for extracting them. But, however numerous and diversified bullet-drawers may be, they all admit of being divided into three kinds. The first are constructed on the principle of a pair of forceps. Others are shaped more or less

like spoons. And a third description are made on the plan of a cork-screw or worm. These last are only designed for cases, in which the ball is fixed in the substance of a bone, and is quite immoveable; for, if it were lodged in the soft parts, the pressure requisite for introducing the screw into it, would injure and lacerate the parts at the bottom of the wound. Bullet-drawers, constructed on the plan of forceps, have the inconvenience of not being adapted for seizing the ball, unless their blades are expanded, which always stretches the wound, and creates a great deal of irritation. Forceps have been contrived with blades, which may be introduced separately, and then joined together with a screw. When a ball lies superficially, the fingers, or a small pair of forceps, will extract it most conveniently. And, with respect to bullet-extractors, as Dr. Hennen has justly observed, they are completely superseded by the common forceps, or that of Baron Percy, though unfortunately the aid of instruments is most required in tortuous deep passages, where we can least make use of them. (*Principles of Military Surgery*, p. 76, Ed. 2.)

The event of the treatment above recommended, is various. Extraneous substances remaining in the wound, either loosen gradually, and come into view so as to be easily removeable; or they continue concealed, prevent the cure, and give birth to a fistulous ulcer. In some instances, the wound closes, and the foreign bodies remain in the limb during life, without inconvenience; and in other cases, after a time, they bring on a renewal of inflammation and suppuration. Sometimes a foreign body varies its situation, sinking down, and afterward making its appearance at a different part, where it may excite inflammation and suppuration.

When the ball lodges in the wound, it is usually difficult to trace it, as the parts collapse after its passage, and leave an opening in the skin much smaller than the ball itself. The ball does not regularly take a straight direction through the injured part, but often a very tortuous one, particularly when the ball is nearly spent. In every case, in which it is not easily discoverable, all painful examinations should be abandoned, and the foreign body left in its situation, until its place is better known, and the first inflammation is over.

Sometimes, the ball may be both easily found and extracted. At other times, it lodges on the opposite side of the limb, closely under the skin. According to Mr. Hunter, if the integuments, under which the ball is lodged, should be so contused that they will probably slough, they are to be considered as already dead, and an opening is to be made in them for the extraction of the ball. But, when the ball lies so remotely from the skin that it can only just be felt, and the skin itself is quite uninjured, no counter-opening ought to be made. The wound heals better when the ball is left in, and far less inflammation takes place in the

vicinity of this extraneous body, than about the orifice of the wound. A counter-opening always renders the inflammation at the bottom of the wound, as great as at its orifice. It is better to let the wound heal up, and extract the ball afterward. (See *Hunter*, p. 541.)

To the justness of this advice, Mr. Guthrie does not assent, who assures us, that he has cut out a great number of balls, which were not more than an inch from the surface, and never found any inconvenience ensue. But when the ball lies three or four inches from the surface, and cannot be distinctly felt, he thinks that no incision should at first be made with the view of extracting it. (*On Gunshot Wounds*, p. 94, 95, Ed. 2.)

Sometimes, the ball penetrates the spongy part of a bone, and lodges firmly in it. When it has only entered superficially, it may sometimes be loosened and extracted, by means of an elevator with a thin and somewhat curved extremity, and when it is more firmly fixed, a screw bullet-drawer will sometimes serve for its removal. Should the attempt fail, the employment of a trepan for the removal of the ball is recommended by some writers; while others, fearful of the irritation, difficulty, and effects of such an operation, and recollecting that balls have sometimes remained fixed in bones for many years, without any serious inconvenience, condemn that practice. On the contrary, Mr. Guthrie lays it down as a general rule, subject to a few exceptions, that a ball should never be allowed to remain in a bone; for, says he, "if a ball lodge in the head of a bone, and is not removed, it generally causes caries of the bone, disease of the joint, amputation, or death. If in the shaft of a long bone, necrosis for the most part follows, with months and years of misery. On a flat bone, caries is equally the result, and if it be surrounded by large muscles, sinuses form in various directions, contractions of the limb take place, and the patient drags on for years, careless of life, and ready to submit to any thing to obtain relief." (*On Gunshot Wounds*, p. 91—93, Ed. 2.) In many of these cases, one thing deserves to be recollected, however, that the necrosis, abscesses, and sinuses are less the effect of the lodgment of the ball, than of the violence originally committed on the parts, against which it has struck. Although Baron Larrey only sanctions the attempt to remove balls with a trephine, when they actually produce dangerous effects, (*Mém. de Chir. Mil. T. 4, p. 185*.) I am disposed to believe, that whenever the situation of the ball is such, that it can be removed at once from a bone with tolerable certainty, and without too much irritation, the practice is commendable. This branch of the treatment of gunshot wounds appears to me still to require further elucidation, for though experience has been abundant, the right rules and principles of practice are not yet laid down in the best modern works.

As soon as the requisite incisions are made, and foreign bodies extracted, the prime objects in the treatment of gunshot wounds are accomplished, and the rest is, in reality, not different from the surgery of other wounds.

With regard to probing gunshot wounds; when it is evident that the shot has passed out, and no particular object can be fulfilled with the probe, it is often better to dispense with such examination. at least till suppuration has come on. Introducing any instrument is generally productive both of pain and irritation. But when the ball, or any other extraneous substance, has lodged in the wound, and its situation is not immediately evident, it will often be advisable to search for it at once, in order that it may be extracted, if its situation will allow, before inflammation begins. The surgeon, therefore, considering all the circumstances which can assist him in forming a reasonable conjecture of the course of the wound, must give to a probe that curvature or form, which he thinks most likely to pass readily along it, and must then proceed to make the examination. But, when this is very painful, and the course of the wound obscure, it will often be better to desist, and renew the search when suppuration has taken place, in which stage it can be undertaken with more ease, and a greater prospect of success. When gunshot wounds are inflamed, the tenderness and swelling of the parts are peculiarly strong reasons against painful probings, or efforts to extract foreign bodies, as long as this state lasts. (See *Chevalier's Treatise on Gunshot Wounds*, p. 67, 68, Edit. 3.)

There is no fact in the practice of surgery better established, than that the cramming of narrow stabs and gunshot wounds with lint, is particularly hurtful. The only possible reason for doing so in the latter cases must be to keep the orifice of the wound from healing up, and confining extraneous bodies; matter, &c. The apprehension of this happening at first is quite unfounded; for the inside of the mouth of the injured part is often lined with a slough or eschar, which must necessarily be detached before the parts can heal. The first dressings, therefore, should be quite superficial, and of a mild unirritating nature. On the field of battle, indeed, it would be well for many of the wounded, if the surgeon were to content himself with applying simple pledgets, and covering the part with linen wet with cold water. This method would prove much more beneficial, than the hasty and indiscriminate use of adhesive plasters, sutures, and tight bandages, from the bad effects of which thousands of soldiers have lost limbs, or lives, which, under more judicious treatment, might have been saved. Hunter used to employ fomentations, pledgets of simple ointments, and frequently over the latter an emollient poultice. In the suppurative stage of gunshot wounds, poultices are generally allowed to be the best applications.

Possessing these ideas, I cannot altogether approve the following directions, though

they are certainly better than are given in many surgical books. "A small bit of soft lint may be placed lightly between the lips of the wound, in order to keep it from closing. In some instances, it should be introduced a little beyond the lips, in order to conduct off the fluids effused, and to prevent irregular adhesions from forming near the surface during the inflammatory stage; as these would impede the direct exit of the discharge. But the wound is not to be filled with lint, much less crammed with it. A pledget of some simple ointment being then laid on, with tow or cloths to receive the discharge, and these prevented from coming off by a bandage loosely applied, the patient may be put to bed, and so placed, if possible, as to keep the orifice of the wound dependent." (*Chevalier*, p. 125, 126.) The reasons for what I consider objectionable, namely, introducing lint on first dressing the wound, are too frivolous to need comment.

In considering the effects of poultices and cold applications upon gunshot wounds, Mr. Guthrie expresses his decided preference to the use of cold water:—"The inflammation is, in some instances, materially prevented, in many greatly controlled, and, in almost all, very much subdued by it, whilst the suppurative process is not impeded in the generality of cases, in a degree sufficient to interrupt the subsequent one of granulation. In all simple cases of gunshot wounds, that is to say, flesh wounds, in persons of a healthy constitution, a piece of lint, which has been dipped in oil, or on which some ointment has been spread, is the best application at first to prevent irritation, with two slips of adhesive plaster placed across to retain it in its situation. A compress, or some folds of linen, wetted with cold water, are then to be applied over it, and kept constantly wet and cold, even by the use of ice, if it can be obtained, and be found comfortable to the feelings of the patient. A roller is of no use, except to prevent the compress from changing its position during sleep, and is, therefore, at that period useful; but as a surgical application, it is useless, if not positively injurious, because it binds a part, which ought, to a certain extent, to swell, and by pressure causes irritation. Rollers ought not to be applied surgically until after some days have elapsed, and it is inexpedient to employ them in the field of battle, even if they were useful, except where some parts are to be kept in position; because, when they are applied in the first instance, they soon become stiff and bloody, are for the most part cut, and are seldom preserved after the first dressing, so as to become useful at the period, when the surgical application of a roller is indispensable." To this just censure of the wrong employment of rollers, Mr. Guthrie annexes some remarks, in which he enters into a general condemnation of poultices, as applications to gunshot wounds, believing, that in many instances, cold water may be employed with the best effect, during the whole progress of the cure. These remarks are tem-

pered with the following admission :—"Cold water is not, however, an infallible, or even always an advantageous remedy ; there are many persons, with whom cold applications do not agree ; there are more, with whom they disagree after a certain period ; and, in either case, they should not be persisted in. Cold does no good in any stage of inflammation, when the sensation accruing from the first application of it is not agreeable to the feelings of the patient ; when, in fact, it does not give relief ; for, if it produces a sensation of shivering, or an uncomfortable feeling of any kind, with stiffness of the part, it is doing harm, and a change to the genial sensation of warmth will not only prove more agreeable, but more advantageous. This occurs in general about the period when suppuration has taken place ; and cold, in such cases, is preventing the full effect of the action, which warmth encourages. Fomentations are then proper ; and, if a poultice be preferred for convenience, by day or by night, an evaporating one of bread will be found sufficient. In the spring of the year, the marshmallow makes an excellent poultice, and so do turnips, gourds, carrots, &c. independently of oatmeal, linseed-meal, Indian-meal, and other farinaceous substances. In all those cases where a poultice is resorted to, as much attention is to be paid to the period of removing, as of applying it. It is used to alleviate pain, stiffness, swelling, the uneasiness arising from cold, and to encourage the commencing, or interrupted action of the vessels towards the formation of matter ; and, as soon as the effect intended has been gained, the poultice should be abandoned, and recourse again had to cold water, with compress and bandage." (*P. 62—67. Ed. 2.*) Although I fully coincide with Mr. Guthrie, respecting the general advantage of cold water, the dangers of tight bandages, and the bad effects of continuing poultices too long, I do not join him in many of the sentiments which he has expressed about these last invaluable applications. On the contrary, I appreciate them as the best means, wherever a slough is to be thrown off, or matter is decidedly forming, and as these effects are very frequent in cases of gunshot wounds, my own opinion of the utility of cold applications is limited to the first three or four days after the receipt of the injury. Nor ought cold applications ever to be continued, where the torpor, low temperature, and languid circulation in the limb, indicate a risk of gangrene. Hence, when a principal artery is tied, their employment is always wrong and hazardous. At the same time, I have no hesitation in declaring my firm belief, that fifty times more mischief has been done by tight rollers applied to recent gunshot wounds, than by either poultices, or cold applications.

Formerly, when the track of the ball had two apertures, a seton was sometimes drawn through it, with the view of preventing a premature closure of the wound, and introducing proper applications. The seton was, also, imagined to give free vent to pus, and

to promote the evacuation of foreign bodies. But a gunshot wound is little inclined to close prematurely, and while a seton rather obstructs the exit of pus, it may as easily push foreign bodies more deeply into the limb, as out of it. There are preferable modes of applying the necessary remedies, and, as a seton is an extraneous substance itself, its employment cannot fail to be highly pernicious.

Gunshot wounds generally demand the employment of antiphlogistic means, just as other cases, attended with equal inflammation. When they are in the inflamed state, the application of leeches is highly proper. In these cases, bleeding is recommended, and in such a manner as if it were of more service in them, than wounds in general. But the necessity for the practice is really not greater than in other wounds, which have done the same degree of mischief, and from which the same quantity of inflammation and other consequences are expected. Bleeding is certainly proper here, just as it is in all considerable wounds attended with a strong full habit, and great chance of extensive inflammation, and much symptomatic fever. In every instance, however, the practitioner must take particular care not to be too bold in the practice of bleeding : for when the patient is reduced below a certain degree, his strength is inadequate to support the large and long-continued suppurations which often cannot be avoided. (*See Hunter, p. 563, 564.*)

As the orifices of the vessels torn by the ball are compressed, and, as it were, obliterated, sometimes no hemorrhage of importance is remarked at first. But, as I have already stated, after some days, and frequently at a very late period, when the sloughs separate, copious hemorrhages may occur, which are the more dangerous as they come on unexpectedly, and often when the suppuration has already induced great debility. The surgeon himself may occasion the bleeding, by removing the dressings carelessly. Hence, in every case, where, from the situation of the wound, there is reason to apprehend injury of some considerable vessel, the patient must be constantly and attentively watched, and every thing necessary for the immediate stoppage of hemorrhage provided.

Another kind of hemorrhage, still more dangerous than the former, particularly occurs in such gunshot wounds as have long been in a state of copious suppuration. The blood does not issue from one individual vessel, but from the whole surface of the wound, as from a sponge, and is so thin as to resemble blood and water. This hemorrhage is very dangerous, because it is particularly apt to exhaust the patient, who is already debilitated, and its causes are difficult of removal. The case demands the exhibition of bark, and diluted sulphuric acid ; the decoction of bark, with a proportion of muriatic acid, being applied to the wound. (*Richter.*)

Gunshot wounds, in crowded military hospitals, especially when they are established in unhealthy, low situations, and due atten-

tion is not paid to ventilation, cleanliness, and fumigations with nitric acid gas, are often attacked with hospital gangrene, a very serious and dangerous complication, of which I shall speak under the head of *Hospital Gangrene*.

The plan of removing the first dressings too soon is as injurious in gunshot wounds as other cases, by creating a premature disturbance of the parts. This observation is particularly true, where dry lint has been used, and it is adherent to the wound. Unless the occurrence of bleeding, severe pain, or other untoward symptoms, were to render a different line of conduct necessary, I think such dressings should rarely be removed before the end of the fourth day. And, if cold water has not been continually applied over the lint, so as to keep it moist, or if such lint has not been spread with some mild salve, or dipped in oil, I deem it a good rule to apply an emollient poultice over it the evening preceding the morning on which the dressings are to be first changed. By this means, they will be loosened, and admit of being taken away without pain or irritation. With the same view, plenty of warm water should be squeezed from a sponge, and allowed to fall upon the dressings. Pledgets of oil, or ointment, should generally be taken off earlier than dry lint, for they are less adherent, and in warm weather, soon become rancid and irritating.

For the first days, the matter seldom assumes a healthy appearance; but as soon as the sloughs separate, it then becomes of a proper quality, and the wound is to be treated as a simple abscess.

Sometimes the healing process does not commence, though suppuration has prevailed a considerable time. On the contrary, notwithstanding the exhibition of tonics, and a generous diet, the suppuration ceases to proceed favourably, and the wound becomes unhealthy, and the matter thin. The bones show no disposition to unite, and the patient, reduced by hectic symptoms, is rapidly approaching dissolution. In this state, life may sometimes be preserved by amputation; the *anceps*, but *unicum remedium*. We ought never to be deterred from undertaking the operation by the fever and weakness, which frequently soon disappear when the local cause is removed.

OF AMPUTATION IN CASES OF GUNSHOT WOUNDS.

The 2d edition of this dictionary, published in 1813, contained all the valuable observations of Baron Larrey, in favour of immediate amputation in every instance in which the operation is considered indispensable. Since then, the public have been favoured with several good practical books, in which the propriety and necessity of early or immediate amputation in such cases are urgently inculcated, and the truth of the doctrine is illustrated by additional facts. It is to be observed, however, that for nearly two hundred years past, there have always

been some advocates for this judicious practice. "Du Chesne (says Dr. J. Thomson) is the first writer on military surgery, in whose works I have found the recommendation to amputate in the severer injuries of the extremities; and it is worthy of remark, that he directs the operation to be performed before inflammation and other constitutional symptoms shall have supervened." (See *Traité de la Cure générale et particulière des Arcubusades*. Par Jos. Du Chesne; Paris, 1625, p. 143; and Thomson's Report, &c. p. 160.) Wiseman not only recommended and practised immediate amputation; but the same thing was not unfrequently done by the military surgeons of his time. (*Chirurgical Treatises*, by R. Wiseman, 3d Edit. London, 1696, p. 410.) The celebrated Le Dran, in his excellent little manual of military surgery, declared himself an advocate for immediate amputation in all cases, in which that operation from the first appears to be indispensable. Le Dran has at the same time stated briefly, but most distinctly, the comparative advantages of that practice, with those which may be expected by delay. (See *Traité où Réflexions tirées de la Pratique sur les Plaies d'Armes à feu*. Par H. F. Le Dran; à Paris, 1737.) Ranby, who was surgeon to King George II. entertained similar opinions to those of Le Dran, with regard to the utility of immediate amputation. In order to give immediate relief to the wounded, and to facilitate the performance of the necessary operations, Ranby proposed, that the surgeons, during battle, should be collected into small bodies, and stationed in the rear of the army. (See the *Method of treating Gunshot Wounds*. By John Ranby. Edit. 3, p. 29. London, 1781.)

After the battle of Fontenoy, in the year 1756, the Royal Academy of Surgery in France offered a prize for the best dissertation on the gunshot injuries requiring immediate amputation, and on other cases of the same nature, where the operation, though deemed inevitable, might be delayed. *L'amputation étant absolument nécessaire dans les playes compliquées de fracas des os, et principalement celles qui sont faites par armes à feu, déterminer les cas où il faut faire l'opération sur le champ, et ceux où il convient de la différer, et en donner les raisons.* The prize was adjudged to the dissertation of M. Faure, the main object of whose paper was to recommend delaying the operation. The side of the question espoused by M. Faure has found some modern advocates of distinguished talents and celebrity. Suffice it to mention the names of Hunter, Baron Percy, and Lombard. It is, however, only justice to M. Faure to state in this place, that, though he regarded immediate amputation as full of danger, he admitted, that there were several kinds of injuries of the extremities, in which it was indispensably and immediately required. "The enumeration (says Dr. Thomson) which this author has given of these injuries, is more full and distinct than any which had been published before his time; and, what may appear singular, it does not

differ, in any essential respect, from the enumeration given by later writers, who, in combating his opinions, have represented him as an enemy to amputation in almost all injuries of the extremities." (See *Report of Observations made in the Military Hospitals in Belgium*, p. 169.)

In 1792, Baron Percy, who was a few years ago at the head of the medical department of the French army, published a book, in which he gives a preference to delaying amputation at first; even in cases where it is certain that the operation cannot ultimately be dispensed with. (See *Manuel de Chirurgien d'Armée*.) Even as late as 1804, Lombard, Professor in the Military Academy of Strasburg, defended the doctrines of M. Faure. (See *Clinique Chirurgicale des Plaies faites par armes à feu*.)

Although, in France, the academy of surgery thought proper to decree the prize to M. Faure, whose doctrine thus received the highest approbation, yet, in that country, very opposite tenets were set up by some men of distinguished talents and extensive military practice. Thus Le Dran, consulting surgeon to the French army, in his work on gunshot wounds, published in 1737, expressly states, "That when the amputation of a limb is indispensably necessary in the case of a gunshot wound, it ought to be done without delay." (*Aphorism 9*.) De La Martinière in particular also wrote some excellent arguments in reply to Bilguer; arguments which, I think, would do honour to the most accomplished surgeon of the age in which we live. (See *Mémoire sur le Traitement des plaies d'armes à feu*, in *Mém. de l'Acad. de Chirurgie*, T. 11, p. 1, Edit. in 12mo.) M. Boucher, of Lisle, was an advocate for the same side of the question. (See *Obs. sur des plaies, d'armes à feu*, &c. in *Mém. de l'Acad. de Chirurgie*, Tom. 5, p. 279, &c. Edit. in 12mo.) Schmucker, who was many years surgeon-general to the Prussian armies, published in 1776, an essay on amputation, in which he particularly mentions, that, during his stay at Paris in 1738, the surgeons of the Hôtel Dieu had been in the habit of performing immediate amputation in severe injuries of the extremities. He also declares himself an advocate for operating immediately, in all cases in which amputation from the first appears to be necessary, and insists, in a particular manner, on the increased danger which he had seen arise from the operation during the second period. He gives (as Dr. J. Thomson has observed) a minute and circumstantial enumeration of those injuries, both of the upper and lower extremities, in which he conceived amputation to be necessary, and in many of which he had actually performed it with great success. Schmucker appears to Dr. Thomson to have given a better account than any preceding military surgeon of the injuries of the thigh; and from the results of his experience, he was led to believe, that though compound fractures of the lower part of the thigh-bone might, in favourable circumstances, be cured without amputation, yet that this operation is peculiarly

necessary in all cases, in which the fracture is situated in, or above, the middle of that bone. (J. L. Schmucker, *Vermischte Chirurgische Schriften*, B. 1. Berlin, 1785.) With the foregoing high authority we have to join one of not less celebrity, namely, that of Baron Larrey, who has proved most convincingly, that when amputation is to be done in cases of gunshot wounds, nothing is so pernicious as delay. (See *Mémoires de Chirurgie Militaire*, Tom. 2, p. 451, &c.)

It becomes me here to state, also, that the principles inculcated by Baron Larrey, are, in point of fact, the same as those which were so strenuously insisted upon by Mr. Pott, whose principal remarks on the necessity of amputation in certain cases, are detailed in another part of this publication. (See *Amputation*.) Mr. Pott, indeed, was not an army surgeon, and what he says was not particularly designed to apply to military practice; but he has represented, as well as any body can do, the propriety of immediate amputation for injuries which leave no doubt that such operation cannot be dispensed with.

Mr. John Bell, among the moderns, appears to me likewise to have much merit for the able manner in which he defended the propriety of early amputation, long before the sentiments of later writers were ever heard of. He distinctly states, that "amputation should, in those cases where the limb is plainly and irrecoverably disordered, be performed upon the spot." (See *Discourses on the Nature, &c. of Wounds*, p. 488, Edit. 3.) In short, notwithstanding all the modern pretensions to novelty upon this interesting topic, we must acknowledge, with Dr. Thomson, that the evidence in favour of the advantages of immediate amputation, has always preponderated over that for delay. (See *Report of Obs. made in the Military Hospitals in Belgium*, p. 226.)

The strongest body of evidence upon this matter, is undoubtedly adduced by Baron Larrey, whose situation at the head of the medical department of the French armies afforded him most numerous opportunities of judging from actual experience. "Upon this subject, (says he,) now that twenty years of continual war have carried our art to the highest pitch of perfection, there can only be one opinion. It is after having incessantly directed the medical service all this time, in quality of head surgeon and inspector-general of the armies, that I proceed to discuss the different opinions delivered in the academy, and to settle definitively this great question, which I regard as the most important in military surgery.

"If we are to be told, that the amputation of a limb is a cruel operation, dangerous in its consequences, and always grievous for the patient, who is thereby mutilated; that, consequently, there is more honour in saving a limb than in cutting it off with dexterity and success; these arguments may be refuted by answering, that amputation is an operation of necessity, which offers a chance of preservation to the unfortunate, whose death

appears certain under any other treatment; and that if any doubt should exist of amputation being absolutely indispensable to the patient's safety, the operation is to be deferred till nature has declared herself, and given a positive indication for it. We are also justified in adding, that this chance of preservation is at the present day much greater, than at the epoch of the academy of surgery. We learn from M. Faure, that, of about three hundred amputations performed after the battle of Fontenoy, only thirty were followed by success, whilst, on the contrary, says Baron Larrey, we have saved more than three-fourths of the patients on whom amputation has been done, and some of whom also had two limbs removed. This improvement is ascribed by Larrey, 1st, To our now knowing better how to take advantage of the indication and favourable time for amputating. 2. To the better method of dressing. 3. To the mode of operating being more simple, less painful, and more expeditious, than that formerly in vogue."

To the preceding authorities against delaying amputation, in cases of gunshot wounds requiring such operation, I have to add Mr. Guthrie, deputy inspector of military hospitals, whose opportunities of observation, during the late war in Spain, were particularly extensive. In his work, he has detailed the opinions of many eminent foreign and British surgeons, respecting the propriety, or impropriety, of the doctrine of immediate amputation; and he has introduced some good criticisms, particularly on Bilguer's statement of the success which was experienced in the Prussian hospitals, from not performing the operation. Mr. Guthrie, however, does not recommend amputation to be done immediately, if the patient be particularly depressed by the shock of the injury directly after its receipt; a piece of advice, which I believe has in reality been at all times followed, not only in respect to amputations in cases of gunshot wounds, but all other severe local injuries. "I believe it to be (says Mr. Guthrie) a stretch of fancy in those surgeons who conceive, that if the knife followed the shot in all cases, the patient would have the best chance of success. No one will deny, that if the shot performed a regular amputation, it would not be better than to have it to do afterward; but if they mean to say the operation should in general be performed immediately after the injury, I can only oppose to them the facts above stated, and the general result of my experience, which is decidedly in favour of allowing the first moments of agitation to pass over before any thing be done; a period extending from that to one, six, or eight hours, according to the difference of constitution, and the different injuries that have been sustained. But from one to three hours will in most cases be found sufficient." (*On Gunshot Wounds*, p. 226, Edit. 2, Lond. 1820.) In the first edition of this gentleman's book, some little want of precision rather concealed his exact meaning, with respect to the period of time which should generally be allowed to transpire between the receipt of the injury and the per-

formance of amputation; but after all the disposition to controversy upon this point, it appears there is little to fight about, as there is rather a misunderstanding, than a difference of opinion. All acknowledge the advantage of doing the operation immediately, when the patient is not faint and depressed by the shock of the accident; all admit the prudence of deferring the use of the knife in other cases until the constitution has revived sufficiently to be capable of bearing the removal of the limb. (See *A. C. Hutchinson, Pract. Obs. in Surgery*, 8vo. Lond. 1816; and his further *Observations on the proper period for amputating in Gunshot Wounds*, 1817. *Quarrier, in Med. Chir. Trans.* Vol. 8; and *Dewar, in Med. Chir. Journ.* April, 1819.)

As far as my experience goes, when the necessity of amputation is undoubted, all delay is improper beyond the short period, during which the faintness immediately arising from the injury usually lasts. In the campaign in Holland, 1814, the most successful amputations were those done in the field hospitals directly after the arrival of the patients, or rather, as Dr. Hennen has expressed it, with as little delay as possible. "While hundreds are waiting for the decision of the surgeon, he will never be at a loss to select individuals, who can safely and advantageously bear to be operated upon, as quickly as himself, or assistants, can offer their aid; but he will betray a miserable want of science indeed, if, in this crowd of sufferers, he indiscriminately amputates the weak, the terrified, the sinking, and the determined. While he is giving his aid to a few of the latter class, encouragement and a cordial will soon make a change in the state of the weakly, or the terrified; and a longer period, and more active measures, will render even the sinking proper objects for operation." (*On Military Surgery*, p. 45, Ed. 2.) It appears from some returns, collected by Mr. Guthrie, that in the peninsula, the comparative loss in secondary or delayed operations, and in primary, or immediate amputations, was as follows:—

	Secondary.	Primary.
Upper extremities	12 to	1
Lower extremities	3 to	1

The great success attending amputation on the field of battle was also convincingly proved after the battle of Toulouse. Here of 47 immediate amputations, 38 were cured, while of the 51 delayed operations, on that occasion, 21 had fatal terminations. (P. 42—44, Ed. 1.) After the attack on New Orleans, out of 45 primary amputations, 38 patients recovered, while only 2 of 7 secondary amputations terminated in the preservation of the patients. (*Op. cit.* p. 294, Ed. 2.)

OF IMMEDIATE AMPUTATION.

When a limb, that has received a gunshot wound, cannot be saved, amputation should be immediately practised. The first four and twenty hours, Baron Larrey observes, are the only time that nature remains tranquil.

(I should say, she does not remain quiet so long,) and we must hasten to take advantage of this period, in order to administer the necessary remedy.

In the army, a variety of circumstances make the urgency for amputation still greater. 1. The inconvenience attending the transport of the wounded from the field of battle to the military hospitals, in carriages badly suspended, the jolting of which would produce such disorder in the wound, and in the whole body, that most patients would die in the journey, especially if it were long, and the weather either extremely hot or cold.

2. The danger of a long continuance in the hospitals; a danger, which amputation materially diminishes, by changing a gunshot injury into a wound, that may be speedily healed, and reducing the causes of fever, and the hospital gangrene.

3. The cases, in which there is a necessity for abandoning the wounded. In this circumstance, it is of importance to have amputated, for after the operation, the patients may remain some days without being dressed, and the dressings are afterward more easy. Besides, it might often happen, that these unfortunate objects would not meet with surgeons of sufficient skill to do the operation; a circumstance, says Larrey, that we have seen happen among certain nations, whose caravans, for the medical service of the army (*ambulances*), are not constructed like those in use with the French.

OF CASES, IN WHICH AMPUTATION SHOULD BE DONE IMMEDIATELY.

First case. A limb carried away by a cannon-ball, or the explosion of a howitzer, or bomb, requires amputation without any loss of time: the least delay puts the patient's life in danger.

In this case, the necessity of the practice is inculcated by M. Fauré himself, as well as by Schmucker, Richter, Larrey, Dr. Thomson, and every modern writer upon gunshot wounds.

When a cannon-ball has torn off a limb, amputation of the stump should be performed, in order to procure the patient an even, smooth incision, instead of an irregular, jagged, and highly dangerous wound. As the limb has commonly suffered a violent concussion, is almost bereft of sense, and power of motion, and the bone frequently has a fissure extending some way upward, the amputation is sometimes recommended to be done, if possible, above the nearest joint. Were the operation not done, this kind of injury would require large and free incisions, for the extraction of foreign bodies, the shortening of projecting muscles and tendons, and the discharge of abscesses; and as these incisions are likely to occasion at least as much irritation as amputation itself, without being productive of equal good, the avoidance even of pain cannot be urged as a reason against the practice. The occasional healing of such wounds only proves, that it is

not altogether impossible, in certain instances, to effect a cure without amputation. The surgeon can the more readily make up his mind to amputate, as in this case, the operation does not occasion the loss of a limb. As for the place of the incision, no one would be justified in amputating above the knee, when the limb is injured at the foot or ankle.

The skin has been violently stretched and lacerated; the muscles have been ruptured and irregularly torn away; the tendons and aponeuroses lacerated; the nerves and vessels divided and forcibly dragged; lastly, the bones broken and smashed to a greater or lesser extent. These first effects are followed by a general, or partial commotion; by a kind of torpor in the injured part, and a good way above the wound; by a painful trembling in the remains of the member, an event that is singularly afflicting to the patient; and by a local swelling preceding the erethismus, which quickly shows itself. The hemorrhage, says Baron Larrey, an accident much more to be apprehended than has been supposed, often comes on a few moments after the injury, and if prompt succour were not afforded, would put a period to the patient's existence. "I can even declare, that had it not been for the activity of the train of flying surgical carriages, (*ambulances volantes*) by means of which the wounded have always been dressed upon the field of battle, many soldiers would have perished from this accident alone."

If the operation is not speedily done, pain commences, fever occurs, and the functions of the system become disordered; the irritation then increases, and convulsive motions take place. If the patient should not be a victim to these first symptoms, gangrene of the stump follows, the fatal consequences of which it is extremely difficult to prevent.

After this short exposition, it is easy to see, that in this case, amputation ought to be practised immediately, and to delay the operation, and merely apply simple dressings, would be affording time for the preceding accidents to arise.

At Strasburgh, during the bombardment of the fort of Kell, in 1792, three volunteers, says Baron Larrey, had limbs shot off by the explosion of shells: one, an arm; another, a fore-arm; and the third, a leg. They were conveyed to the hospital for the wounded in that town, which was superintended by M. Boy. Several days were suffered to elapse before the amputation was performed; not one of the patients escaped.

At Mentz, after the retreat from Frankfurt, several of the wounded, who had had limbs shot off, did not have amputation done till some time afterward, and not one of them recovered.

At Nice, after the taking of Saorgio, two amputations were practised at the Hospital, No. 2; one of the fore-arm, the other of the arm, nine or ten days after the receipt of the injuries: both the patients died.

At Perpignan, Baron Larrey visited two soldiers, on whom amputation had been done, seven or eight days after the receipt

of gunshot injuries in the action of the 14th of July, 1794. One had had a leg shot off, and the other his right arm. Notwithstanding Larrey's utmost care, he could not save their lives: one died of tetanus; the other of gangrene.

In the month of August, 1805, two cannoniers of the guards, in discharging the artillery, had each a hand shot away, and all the forepart of their bodies burnt. These were the two men whose office it was to charge the gun. At the moment when they had just rammed down the wadding on the cartridge, a spark, that had been left unextinguished, from the neglect to keep the touch-hole closed, set fire to the powder: the ram-rod was violently repelled by the explosion, together with every thing that was situated in front of the charge. The right hand of one of the cannoniers was completely torn off, between the two phalanges of the carpus, and thrown more than two hundred paces. The counter shock even threw the man down into the ditch of the square of the Hôtel des Invalides. The left hand of the other cannonier was torn away, together with the fore-arm of the elbow-joint, and also forced to a considerable distance. The tendons and muscles sustained vast injury, and the worst symptoms would have occurred if amputation had not been instantly performed. In one case, amputation was done at the wrist; and in the other at the lower third of the arm. The two operations were followed by complete success, although the burns upon the face and chest, in both the patients, were serious and extensive.

Second case. When a body, propelled by gunpowder, strikes a limb in such a manner as to smash the bones, violently contuse, lacerate, and deeply tear away the soft parts, amputation ought to be immediately performed. If this measure be neglected, all the injured parts will soon be seized with gangrene: and besides, as Larrey has explained, the accidents which the gravity of the first case produces, will also here be excited. It is only doing justice to the memory of M. Faure to state, that this second case was one which he also particularly instanced as demanding the immediate performance of amputation. (See *Prix de l'Acad. Royale de Chirurgie*, T. 8, p. 23, Edit. 12mo.)

Third case. If a similar body were to carry away a great mass of the soft parts, and the principal vessels of a limb, (of the thigh, for instance,) without fracturing the bone, the patient would be in a state demanding immediate amputation; for, independently of the accidents which would originate from a considerable loss of substance, the limb must inevitably mortify. Mr. Guthrie also says, "a cannon-shot destroying the artery and vein, on the inside (of the thigh) without injuring the bone, requires amputation." (P. 185.) When, however, the femoral artery, or vein, is injured by a musket-ball, or small canister-shot, this gentleman recommends tying the vessel above and below the wound in it, if the nature of the case be evinced by hemorrhage. But he believes,

that when both vein and artery are injured, amputation is necessary. (P. 186.) With respect to bleeding from the femoral vein, as it may easily be stopped by moderate pressure, the propriety of using any ligature at all is questionable.

"An injury of the femoral artery, (observes Mr. Guthrie) requiring an operation, accompanied with fracture of the bone of the most simple kind, is a proper case for immediate amputation; for, although many patients would recover from either accident alone, none would, I believe, surmount the two united, and the higher the accident is in the thigh, the more imperious is the necessity for amputation." (*Guthrie on Gunshot Wounds*, p. 187.)

Fourth case. A grape-shot strikes the thick part of a member, breaks the bone, divides and tears the muscles, and destroys the large nerves, without, however, touching the main artery. According to Larrey, this is a fourth case, requiring immediate amputation.

Mr. Guthrie seems to coincide on this point with Larrey: "If a cannon-shot strike the back part of the thigh, and carry away the muscular part behind, and, with it the great sciatic nerve, amputation is necessary, even if the bone be untouched, &c. In this case, I would not perform the operation by the circular incision, but would preserve a flap from the forepart, or sides, as I could get it, to cover the bone, which should be short." (*Guthrie on Gunshot Wounds of the Extremities*, p. 184.)

Fifth case. If a spent cannon-shot, or one that has been reflected, should strike a member obliquely, without producing a solution of continuity in the skin, as often happens, the parts which resist its action, such as the bones, muscles, tendons, aponeuroses, and vessels, may be ruptured and lacerated. The extent of the internal disorder is to be examined; and if the bones should feel, through the soft parts, as if they were smashed, and if there should be reason to suspect, from the swelling and a sort of fluctuation, that the vessels are lacerated, amputation ought to be immediately practised. We learn from Larrey, that this is also the advice of Baron Percy. Sometimes, however, the vessels and bones have escaped injury, and the muscles are almost the only parts disordered. In this circumstance, we are enjoined to follow the counsel of De La Martinière, who recommended making an incision through the skin. By this means, a quantity of thick blackish blood will be discharged, and the practitioner must await events. According to Larrey, such incision is equally necessary in the preceding case, before amputation, in order to ascertain the extent of the mischief which the parts have sustained.

It is to such injury, done to internal organs, that we must ascribe the death of many individuals, which was for a long while attributed to the commotion produced in the air. (See *Ravaton, Traité des Plaies d'Armes, à Feu*.)

Although, says Larrey, this opinion has been sanctioned by surgeons of high repute, we may easily convince ourselves of its falsity, if we carefully consider, 1st, the direction and course of solid hard bodies, and their relation to the air, through which they have to pass; 2dly, the internal disorder, observable in the dead bodies of persons, whose death is imputed to the mere impression of the air, agitated by the ball; 3dly, the properties of the elastic substances, such as the integuments, cellular substance, &c. struck by the shot.

It is universally agreed among philosophers, that a solid body, moving in a fluid, only acts upon a column of this fluid, the base of which column is nearly equal to the surface which the solid body presents. (See *Le Vacher sur quelques particularités concernant les playes faites par armes à feu*, in *Mém. de l'Acad. de Chirurgie*, T. 11, p. 34, Ed. 12mo.)

Thus a cannon-ball, in traversing a space equal to its diameter, can only displace a portion of air, in the relation of 3 to 2, compared with the size of the shot. This fluid, in consequence of its divisibility and homogeneity with the ambient air, is dispersed in all directions, and confounded with the total mass of the atmosphere. The effects of this aeriform substance amount to nothing, and not a doubt can be entertained, that if there is the slightest solution of continuity of any part of the body, it must depend upon the direct action of the ball itself.

If, besides, the quickness of the motion of a ball be considered, which quickness is known to diminish in an inverse ratio to the squares of the distance, it will be seen, that the space through which the shot has passed, before striking the object against which it was directed, will already have materially lessened the celerity of the projectile, while the motion of the column of air must be totally lost.

The different movements which the ball describes in its course, and the elasticity of the skin, enable us to explain how internal injuries are produced, without any external solution of continuity, and often even without ecchymosis. The motion, communicated to the ball by the power which projects it, is, for a given space, rectilinear. If, at this instance, it strikes against the body, it carries the part away to an extent proportioned to the mass with which it touches the part. But the ball, after having traversed a certain distance, undergoes, in consequence of the resistance of the air, and the attraction of gravity, a change of motion, and now turns on its own axis, in the diagonal direction.

If the shot should strike any rounded part of the body, towards the end of its course, it will run round a great portion of the circumference of the part, by the effect of its curvilinear movement. It is also in this manner, observes Larrey, that the wheel of a carriage acts in passing obliquely over the thigh, or leg, of an individual stretched upon

the ground. In this case, the results are the same as those of which we have been speaking. The most elastic parts yield to the impulse of the contusing body; while such as offer resistance, as, for instance, the bones, tendons, muscles, and aponeuroses, are fractured, ruptured, and lacerated. For the same reason it sometimes happens, that the viscera are similarly injured.

At first sight, all the parts appear to be entire; but a careful examination will not let us remain long in doubt about the internal mischief. In this case, an ecchymosis cannot manifest itself outwardly, because the vessels of the skin, which communicate with the internal parts, are ruptured, because the extravasation of blood naturally takes place in the deep excavations occasioned by the rupture of the muscles and other parts, and because this fluid cannot make its way through the texture of the skin. Such extravasations can only be detected by the touch.

The foregoing reasoning is supported by experience. How often, says Larrey, have we not seen the ball carry away pieces of helmets, hats, cartridge-boxes, knapsacks, or other parts of the soldier's dress, without doing any other injury? The same ball, perhaps, takes off his arm, often at a time when it is closely applied to the body of his comrade, and yet the latter does not receive the slightest harm. The shot may pass betwixt the thighs, and these members hardly exhibit an ecchymosis at the points, which are gently grazed; the only example in which ecchymosis does occur. In other instances, the ball severs the arm from the trunk, and the functions of the thoracic viscera are not at all injured.

Baron Larrey then relates the following case, which is analogous to one which I saw near Antwerp, and have already mentioned in the foregoing columns. M. Méget, a captain, marching in the front of a square of men, in the heat of the battle of Altzey, 30th March, 1793, had his right leg almost entirely carried away by a large cannon-shot, without the contiguous limb of his lieutenant, who was as close as possible to him, receiving the least injury. The violent general commotion excited, and the extreme severity of the weather, made this officer's condition imminently perilous. The progress of the symptoms, however, was checked by amputation, which was instantly performed. M. Méget was then capable of being conveyed to the hospital at Landau, fifteen leagues from the field of battle, where he got quite well.

Larrey declines relating numerous other analogous amputations, which he has been called upon to practise under the same circumstances. M. Buffy, a captain of the artillery of the army of the Rhine, was struck by a howitzer, his left arm being injured, and his head so nearly grazed, that the corner of his hat, which was placed forwards over his face, was shot away as far as the crown. This officer, the skin of whose nose was even torn off, was not deprived of his

senses, and he was actually courageous enough to continue for some minutes commanding his company. At length he was conveyed to Larrey's ambulance, who amputated his arm: in about a month, the patient was well.

Larrey expresses his belief, that what have been erroneously termed *wind contusions*, if attended with the mischief above specified, require immediate amputation. The least delay makes the patient's preservation extremely doubtful. The internal injury of the member may be ascertained by the touch, by the loss of motion, by the little sensibility retained by the parts, which have been struck; and lastly, by practising an incision, as already recommended.

In order to confirm the principle which he endeavours to establish, in opposition to many writers, Larrey indulges himself with the following digression.

At the siege of Roses, two cannoniers, having nearly similar wounds, were brought from the trenches to the ambulance, which Baron Larrey had posted at the village of Palau. They had been struck by a large shot, which, towards the termination of its course, had grazed posteriorly both shoulders. In one, Larrey perceived a slight ecchymosis over all the back part of the trunk, without any apparent solution of continuity. Respiration hardly went on, and the man spit up a large quantity of frothy vermillion blood. The pulse was small and intermitting, and the extremities were cold. He died an hour after the accident, as Larrey had prognosticated. This gentleman opened the body in the presence of M. Dubois, inspector of the military hospitals of the army of the eastern Pyrenees. The skin was entire; the muscles, aponeuroses, nerves, and vessels of the shoulders were ruptured and lacerated, the scapulæ broken in pieces, the spinous processes of the corresponding dorsal vertebræ, and the posterior extremity of the adjacent ribs fractured. The spinal marrow had suffered injury; the neighbouring part of the lungs was lacerated, and a considerable extravasation had taken place in each cavity of the chest.

The second cannonier died of similar symptoms, three quarters of an hour after his arrival at the hospital. On opening the body, the same sort of mischief was discovered as in the preceding example.

In the German campaigns of the French armies, Larrey met with several similar cases, and accurate examination has invariably convinced him of the direct action of a spherical body, propelled by means of gunshot.

Sixth case. According to Baron Larrey, when the articular heads are much broken, especially those which form the joints of the foot, or knee, and the ligaments, which strengthen these articulations, are broken and lacerated by the fire of a howitzer or a grapeshot, or other kind of ball, immediate amputation is indispensable. The same indication would occur, were the ball lodged

in the thickness of the articular head of a bone, or were it so engaged in the joint, as not to admit of being extracted by simple and ordinary means. (See also Guthrie on *Gunshot Wounds*, p. 197.)

Fractures extending into the joints, and accompanied with great laceration of the ligaments, were cases of gunshot injuries pointed out by M. Faure, as indispensably requiring immediate amputation. (See *Prix de l'Acad. de Chir. T. 8.*) Thus we see, that this author was not so averse to early amputation as several modern writers have represented.

It is only in this manner that the patients can be rescued from the dreadful pain, the spasmodic affections, the violent convulsions, the acute fever, the considerable tension, and the general inflammation of the limb, which, Larrey observes, are the invariable consequences of bad fractures of the large joints. But, adds this author, if the voice of experience be not listened to, and amputation be deferred, the parts become disorganized, and the patient's life is put into imminent peril.

It is evident, says he, that, in this case, if we wish to prevent the patient from dying of the subsequent symptoms, amputation should be performed before twelve, or at most twenty-four hours, have elapsed: even M. Faure himself professed this opinion in regard to certain descriptions of injury. (*Mém. de Chir. Militaire*, T. 2.)

With respect to wounds of the knee, the sentiments of Mr. Guthrie nearly coincide with those of Larrey: "I most solemnly protest (says Mr. G.) I do not remember a case do well, in which I knew the articulating end of the femur, or tibia, to be fractured by a ball that passed through the joint, although I have tried great numbers, even to the last battle of Toulouse. I know that persons, wounded in this way, have lived; for, a recovery it cannot be called, where the limb is useless, bent backward, and a constant source of irritation and distress, after several months of acute suffering, to obtain even this partial security from impending death; but, if one case of recovery should take place in fifty, is it any sort of equivalent for the sacrifice of the other forty-nine? Or is the preserving of a limb of this kind an equivalent for the loss of one man?" (*On Gunshot Wounds*, p. 196.)

In the attack of the village of Merksam near Antwerp early in 1814, a soldier of the 95th regiment was brought to our field hospital, having received a musket-ball through the knee-joint. The staff surgeons on duty, and Mr. Curtis, surgeon of the 1st guards, were preparing to amputate the limb, when a surgeon, attached to the 95th, urgently recommended deferring the operation. Superficial dressings were applied, and the patient sent to the rear. He lived several months after the accident, at times affording hopes of a perfect recovery; but, in the end, he fell a victim to hectic symptoms.

Indeed, such is the general unfortunate

result of these cases, that, Dr. Hennen lays it down as a law of military surgery, that no lacerated joint, particularly the knee, ankle, or elbow, should ever leave the field unamputated, where the patient is not obviously sinking. (*On Military Surgery*, p. 41, Ed. 2.)

According to Mr. Guthrie, fractures of the patella, without injury of the other bones, admit of delay, provided the bone is not much splintered.

Seventh case. Larrey observes, that if a large biscayen, a small cannon-shot, or a piece of a bomb-shell, in passing through the substance of a member, should have extensively denuded the bone, without breaking it, amputation is equally indicated, although the soft parts may not appear to have particularly suffered. Indeed, the violent concussion, produced by the accident, has shaken and disorganized all the parts; the medullary substance is injured, the vessels are lacerated, the nerves immoderately stretched, and thrown into a state of stupor; the muscles are deprived of their tone; and the circulation and sensibility in the limb are obstructed. Before we decide, however, Baron Larrey cautions us to observe attentively the symptoms, which characterize this kind of disorder. The case can be supposed to happen only in the leg, where the bone is very superficial, and merely covered at its anterior part with the skin.

The following are described as the symptoms: the limb is insensible, the foot cold as ice, the bone partly exposed, and on careful examination, it will be found that the integuments, and even the periosteum, are extensively detached from it. The commotion extends to a considerable distance; and the functions of the body are disordered; and all the secretions experience a more or less palpable disturbance. The intellectual faculties are suspended, and the circulation is retarded. The pulse is small and concentrated; the countenance pale; and the eyes have a dull moist appearance. The patient feels such anxiety, that he cannot long remain in one posture, and requests, that his leg may be quickly taken off, as it incommodates him severely, and he experiences very acute pain in the knee. When all these characteristic symptoms are conjoined, says Larrey, we should not hesitate to amputate immediately; for, otherwise, the leg will be attacked with sphacelus, and the patient certainly perish.

Larrey adduces several interesting cases in support of the preceding observations.

Eighth case. When a large gynglimoid articulation, such as the elbow, or especially the knee, has been extensively opened with a cutting instrument, and blood is extravasated in the joint, Larrey deems immediate amputation necessary. In these cases, the synovial membranes, the ligaments and aponeurosis inflame, the part swells, and erythismus rapidly takes place; and acute pains, abscesses, deep sinuses, caries, febrile symptoms, and death, are the speedy consequences. Larrey has seen numerous sub-

jects die of such injuries, on account of the operation having been postponed through a hope of saving the limb. In his *Memoires de Chirurgie Militaire*, Tom. 2, some of these are detailed.

Although a wound may penetrate a joint, yet, if it be small and unattended with extravasation of blood, M. Larrey informs us, it will generally heal, provided too much compression be not employed. This gentleman believes in the common doctrine of the pernicious effect of the air on the cavities of the body; yet, in this place, a doubt seems to affect him: speaking of the less danger of small wounds of joints, he says; "*à quoi tient cette différence, puisque l'air pénètre dans l'articulation dans l'un comme dans l'autre cas?*"

When two limbs have been at the same time so injured, as to require amputation, we should not be afraid of amputating them both immediately, without any interval. We have, says Larrey, several times performed this double amputation, with almost as much success, as of the amputation of a single member. He has recorded an excellent case in confirmation of this statement. (*Mém. de Chir. Militaire*, T. 2, p. 478.)

When a limb is differently injured at the same time in two places, and one of the wounds requires amputation, (suppose a wound of the leg with a splintered fracture of the bone, and a second of the thigh, done with a ball, but without any fracture of the os femoris, or other bad accident) Larrey recommends us, first to dress the simple wound of the thigh, and amputate the leg immediately afterward, if the knee be free from injury. When it is necessary to amputate above this joint, the less important wound need not be dressed, till after the operation, provided it can be comprehended in the section of the member, or be so near the place of the incision as to alter the indication. When the wound, demanding amputation, is the upper one, the operation of course is to be done above it, without paying any regard to the injury situated lower down.

Ninth case. To the foregoing species of gunshot wounds, pointed out by Baron Larrey as urgently requiring immediate amputation, my own experience, and the observations of Dr. Thomson, justify me in adding compound fractures of the thigh from gunshot violence. I am particularly glad, that the latter gentleman has devoted a proper degree of attention to these cases; for, the opportunities which I had of judging when abroad, incline me to believe, that military surgeons are hardly yet sufficiently impressed with the propriety of immediate amputation in gunshot fractures of the thigh. There were brought into my hospital at Oudenbosch in 1814, about eight of such cases, all in the worst state for an operation, because several days had elapsed after the receipt of the injuries. All these patients died, excepting one, whose fracture was not far above the condyles, and I do not know, that he ever regained a very useful limb. An-

other had indeed been rescued by amputation from the dangers of the injury; but was unfortunately lost by secondary hemorrhage about three days after the operation. The bleeding was almost instantly suppressed; yet, such was the weakness of the patient, that the irritation of securing the vessel, and the loss of blood together, destroyed at once every hope of recovery. Were I to judge, then, from my own personal observations in the army, and from some other cases, which I saw under my colleagues, I should without hesitation recommend immediate amputation in all cases of compound fractures of the thigh, caused by grape-shot, musket balls, &c. If there are any exceptions to this advice, they are such as are specified in the article *Amputation*.

"Gunshot fractures of the thigh (says Dr. J. Thomson) have been universally allowed to be attended with a high degree of danger; indeed, till of late years, very few instances have been recorded of recovery from these injuries. Ravaton acknowledges, that, in his long and extensive experience, he had never seen an example of recovery from a gunshot fracture of the thigh; and Bilguer, in his calculations, with regard to those, who recover from gunshot fractures, sets aside those of the thigh-bone, as being of a nature altogether hopeless. In the present improved state of military surgery, instances not unfrequently occur of recovery from this fracture: but, of these, the number will be found, I believe, to be exceedingly small, in comparison with those who die, particularly when the fracture has had its seat above the middle of the bone," &c.

According to the observation of Percy, scarcely two of ten recover of those, who have suffered gunshot fractures of the thigh-bone. Mr. Guthrie, who seems to have paid greater attention to this subject, than any preceding author, says, that "upon a review of the many cases, which I have seen, I do not believe, that more than one-sixth recovered, so as to have useful limbs; two-thirds of the whole died either with or without amputation; and the limbs of the remaining sixth, were not only nearly useless, but a cause of much uneasiness to them for the remainder of their lives." (See *Guthrie on Gunshot Wounds*, p. 19.)

"In fractures by musket bullets of the lower part of the thigh-bone (says Dr. Thomson) recovery not unfrequently takes place; and both Schmucker and Mr. Guthrie conceive, that they are injuries in which amputation may be delayed with safety. It would be very agreeable, that this opinion should be confirmed by future experience; but, it appears to me, that before it can be received as a maxim in military surgery, much more extensive and accurate observation, than we yet possess, will be required, with regard to the proportion of those who recover without amputation, or after secondary operations, and of those who recover after primary amputation. Of those who had suffered this injury, we saw, comparatively, but a small number recover-

ing in Belgium, and they had been attended with severe local and constitutional symptoms." See *Report of Observations made in the Military Hospitals in Belgium*, p. 247, *et seq.*

In the article *Amputation*, I have described the manner in which balls produce fissures of several inches in length in the thigh-bone. This state of the bone, observes Dr. Thomson, must be very unfavourable to recovery, and his conclusion is, that, in general, even in fractures of the lower part of the thigh-bone a greater number of lives will be preserved, in military practice, by immediate amputation, than by attempting the cure without that operation. "When the bone appears on a careful examination, to be broken without being much splintered, and when the patient can be removed easily to a place of rest and safety, it may be right to attempt to preserve the limb; but if the bone be much splintered, or if the conveyance is to be long, or uncertain, it will, in most instances, I am convinced, be a much safer practice, even in fractures of this part of the thigh-bone, to amputate without delay."

"Musket bullets, in passing through the femur, near to the knee-joint, produce fissures of the condyles, which generally communicate with the joint. These cases, like those in which the bullets have passed directly through the joint, require immediate amputation."

"The writings of military surgeons contain but few histories of cases, in which the thigh bone had been fractured above its middle by the passage of musket bullets. These are cases, I believe, which have generally had a fatal termination; and the danger, attendant upon the amputation, which they require, seems long to have deterred surgeons from attempting to ascertain what advantages might be derived from the employment of that operation. Schmucker recommends, and states, that he had practised with success, immediate amputation in those cases, in which a sufficient space was left below the groin for the application of the tourniquet. It is curious to remark, in the history of amputation, how long surgeons were in discovering the ease and safety, with which the femoral artery may be compressed by the fingers, or pads, in its passage over the brim of the pelvis. Boy, from the immediate danger, protracted suffering, and ultimate want of success, which he had observed to follow this kind of injury, urges strenuously the propriety of immediate amputation: Mr. Guthrie's opinion, with regard to the dangerous nature of these injuries, and the advantages to be derived in them from immediate amputation, coincides in every respect with those of Schmucker and Boy. He observes, that, those whose thigh-bone has been fractured in its upper part by a musket bullet, generally die with great suffering, before the end of the sixth, or eighth week; and that few even of those escape, in whom that bone has been fractured in its middle part. Of the few, whom

we saw, who had survived gunshot fractures in the upper part of the thigh-bone in Belgium, scarcely any one could be said to be in a favourable condition. In all, the limbs were much contracted, distorted, and swollen, and abscesses had formed round and in the neighbourhood of the fractured extremities of the bones. In some instances, these abscesses had extended down the thigh; but, more frequently, they passed upwards, and occupied the region of the hip-joint and buttocks. In several instances, in which incisions had been made for the evacuation of matter, the fractured and exfoliating extremities of the bones sometimes comminuted, and sometimes forming the whole cylinder, could be felt bare, rough, and extensively separated from the soft parts, which surrounded them. In other instances, these extremities were partially enclosed in depositions of new bone, which, from the quantity thrown out, seemed to be present in a morbid degree. It was obvious, that, in all of these cases, several months would be required for the reunion of the fractured extremities; that, in some, much pain and misery were still to be endured from the processes of suppuration, ulceration, exfoliation, and ejection of dead bone; that in some cases, the patients were incurring great danger from hectic fever, and from diarrhoea; that the ultimate recovery in most of them was doubtful, and that of those in whom this might take place, there was but little probability, that any would be able to use their limbs! The sight of these cases (says Dr. Thomson) made a deep impression upon my mind, and has tended to increase my conviction, that this is, of all others, the class of injuries, in which immediate amputation is most indispensably required." (See *Report of Observations made in the Military Hospitals in Belgium*, p. 254—258.)

Dr. Thomson adds, that what has been said of the danger of fractures, produced by musket bullets, in the upper part of the femur, is true in a still greater degree of those which have their seat in the neck or head of that bone. In such instances, Dr. Thomson joins the generality of modern army surgeons in strongly recommending amputation at the hip-joint; a subject, of which I have already spoken. (See *Amputation*.)

OF GUNSHOT WOUNDS, IN WHICH AMPUTATION MAY BE DEFERRED.

If, says Baron Larrey, it be possible to specify the cases, in which amputation ought to be immediately performed, it is impossible to determine *a priori* those, which will require the operation subsequently. One gunshot wound, for example, will be cured by ordinary treatment, while another, that is at first less severe, will afterward render amputation indispensable, whether this be owing to the patient's bad constitution, or the febrile complaints, which are induced. However this may be, the safe rule for fulfilling the indication, that presents itself, is

to amputate consecutively only in circumstances, in which every endeavour to save the limb is manifestly in vain. Upon this point, Larrey's doctrine differs from that of Faure.

The latter practitioner admits cases, which he terms cases of the *second kind*, in which he delays amputation, not with any hope of saving the limb, but in order to let the first symptoms subside. The operation, done between the fifteenth and twentieth day, appears to him less dangerous, than when performed immediately after the receipt of the injury. At the above period, according to M. Faure, the commotion, occasioned by the gunshot injury, is dispelled; the patient can reconcile himself to amputation, the mere mention of which fills the pusillanimous with terror in a greater or lesser degree; the debility of the individual is no objection; and it is laid down as an axiom "that the consequences of every amputation, done in the first instance, are in general extremely dangerous." In support of this theory, M. Faure adduces ten cases of gunshot injuries, in which, after the battle of Fontenoy, the operation was delayed, in order that it might afterward be performed with more success: a plan, which, according to the author, proved completely successful. (See *Prix de l'Acad. de Chirurgie*, Tom. 8, Edit. in 12mo.)

This division of the cases for amputation in two classes, not consistent with nature, Larrey conceives, has been the cause of a great deal of harm. Very often the partisans of M. Faure have not dared to resort in the first instance to amputation, the dangers of which they exaggerate; while on other occasions, they amputate consecutively without any success.

Larrey, after arguing that the effects of commotion, instead of increasing, gradually diminish and disappear after the operation, ventures into some hypothesis about the proximate cause of the ill effects of commotion, which, as being wild and unsatisfactory, I shall not here repeat.

Baron Larrey will not even admit, that the patient's alarm ought to be a reason for postponing the operation; because the patient, just after the accident, will be much less afraid of the risk, which he has to encounter, than at the expiration of the first four and twenty hours, when he has had time to reflect upon the consequences of the injury, or of amputation; a remark made by the illustrious Paré.

"Experience, agreeing with my theory, (says Baron Larrey) has proved both to the army and navy surgeons, that the bad symptoms which soon follow such gunshot injuries, as must occasion the loss of a limb, are much more to be dreaded, than those of immediate amputation. Out of a vast number of the wounded, who suffered amputation in the course of the first four and twenty hours after the memorable battle of the first of June, 1794, a very few lost their lives. This fact has been attested by several of our

colleagues, and especially by M. Ferroc, surgeon of the ship *le Jemmappe*.

The following is said to be an extract from one of his letters.

"After the naval engagement on the first of June, 1794, a great number of amputations were done immediately after the receipt of the injuries. Sixty of the patients, whose limbs had been thus cut off, were taken to the naval hospital at Brest, and put under the care of M. Duret. With the exception of two, who died of tetanus, all the rest were cured; and there was one, who had both his arms amputated. The surgeon of the *Téméraire*, which ship was captured by the English, was desirous, in compliance with the advice of their medical men, to defer the operation, which many of the wounded stood in need of, till his arrival in port; but, he had the mortification to see them all die during the passage, &c."

Larrey next acquaints us, that, when he was sent to the army of Italy, in 1796, he had also the pain of seeing, in the hospitals, great numbers of the wounded fall victims to the confidence, which many of the surgeons of that army placed in the principles of M. Faure. General Bonaparte saw that the *ambulance volante* was the only thing, that, in the event of fresh hostilities, could prevent such accidents: and, in consequence of his orders, Larrey formed the three divisions d'*ambulance* which are described in his *Mémoires de Chirurgie Militaire*.

Since this period it has always been customary in the French armies, on the day of battle, to make every preparation for performing amputation as speedily as possible. The mere sight of these *ambulances*, (always attached to the advanced guard,) says M. Larrey, encourages the soldiers, and inspires them with the greatest courage. On this occasion, the following anecdote is cited from Ambroise Paré.

This famous surgeon having been urgently sent for by the Duke de Guise besieged in Metz, to attend the wounded of his army, who were in want of assistance, Ambroise Paré was shown to the frightened soldiers at the breach. Upon this, they immediately filled the air with shouts of the most lively joy, and cried out: "*Nous ne pouvons plus mourir, s'il arrive que nous soyons blessés, puisque Paré est parmi nous.*" Their courage revived, and their confidence in this skilful surgeon, contributed to the preservation of a place, before which a formidable army was destroyed.

Larrey desires us to interrogate the invalids, who have lost one or two of their limbs, and nearly all will tell us that they suffered amputation a few minutes after the accident, or in the first four and twenty hours.

"If Faure now retains any partisans," says Larrey, "I recommend them to repair to the field of battle, the day after an action; they would then soon be convinced, that, without the prompt performance of amputation, great number of soldiers must inevita-

bly lose their lives. In Egypt, this truth was particularly manifested."

The following communication upon this point was made to Baron Larrey by M. Masclet, a French surgeon on duty at Alexandria.

"In the naval hospital of this port, I have seen eleven soldiers, or sailors, who were wounded in the naval action off Aboukir, and who had suffered amputation in the first four and twenty hours. In five of these cases, the operation had been done on the arm; in two on the thigh; and in three others on the leg. All these men are recovering. In the army hospital, there have been only three thigh amputations, which we performed seven or eight days after the battle, and these three patients died a few days after the operation, although the operation was done methodically, and no grave symptoms prevailed at the time of its performance. You see, sir, experience has, in this instance, quite confirmed your principles."

In 1780, during the American war, we are informed by Larrey, that the surgeons of the French army performed a great number of amputations, according to the opinion then generally adopted in France, that the operation should not be undertaken till after the subsidence of the first symptoms. Almost all the patients, thus treated, died after the operation. On the contrary, the Americans, who had the boldness to amputate immediately (or in the first twenty-four hours) upon many of their wounded countrymen, lost only a very few. Yet, M. Dubor, at that time surgeon to the Artois dragoons, and from whom Larrey has collected this fact, relates, that the situation of the hospital for the French wounded was, on many accounts, the most advantageous. (*Dubor These Inaugurale soutenue 16 Sept. 1803, à l'Ecole de Strasbourg.*)

Admitting that, by a concurrence of fortunate circumstances, which are not always to be calculated upon, some patients escape the danger of the first symptoms, as Larrey remarks, this proves nothing in favour of doing the operation afterward: it must be seen what nature will do towards the event of the case.

If, at the end of twenty or thirty days, the prognosis is as bad as it was previously, amputation cannot be avoided. Thus all the sufferings, which the patient has endured, have been undergone for nothing, and the operation will now be attended with considerable risk, inasmuch as the patient may lie in a dangerously weakened state.

If nature revives at all, no doubt the success of the operation becomes more probable; but, in this case, the surgeon, instead of having recourse to amputation, should redouble his efforts to preserve the limb.

CASES DEMANDING AMPUTATION CONSECUTIVELY.

Upon this subject Larrey gives us the annexed information.

First case. A spreading Mortification. If the disorder be owing to an internal and general cause, it would then be rashness in the surgeon to amputate before nature had put limits to the disease. Larrey describes this kind of gangrene, as being distinguished from that, which is named *traumatic*, by the symptoms which precede and accompany it. These symptoms are similar to those which are observed in nervous ataxia, or adynamia. Here the operation ought to be deferred, and endeavours made to combat the general causes with regimen and internal medicines.

But, when the gangrene is *traumatic*, Larrey advises the limb to be immediately cut off above the disorganized part. Several facts, in support of this doctrine, are related by this experienced surgeon in his *Mémoire sur la Gangrene Traumatique*. (See *Mortification*.)

In that part of the dictionary will be found several additional observations, in favour of the practice adopted and recommended by Larrey, which is so opposite to that inculcated by Sharp, Pott, and the generality of writers.

In the article *Amputation*, I have noticed a particular case of gangrene, which has been pointed out by Mr. Guthrie, as demanding the early performance of amputation, and a deviation from the old rule of waiting till the mortification has ceased to spread. (See *Guthrie on Gunshot Wounds of the Extremities*, p. 63, &c.)

Second case. Convulsions of the wounded Limb. It is one of Larrey's doctrines, (though of a very questionable description,) that amputation of the member, performed immediately the first symptoms of tetanus manifest themselves, interrupts all communication between the source of the disorder, and the rest of the body. He states, that the operation unloads the vessels, and thus puts a stop to the tension of the nerves, and to the convulsions of the muscles. These first effects, he says, are followed by a general collapse, which promotes the excretions, sleep, and the equilibrium of every part of the system. He argues, that the whole of the momentary pain caused by the operation, cannot increase the existing irritation: besides the sufferings of tetanus render those of amputation more bearable, and lessen their intensity, especially when the principal nerves of the limb are strongly compressed. Some observations will be made on this proposal in the article *Tetanus*.

Third case. Bad State of the discharge. It often happens, that in gunshot wounds, complicated with fractures, notwithstanding the most skilful treatment, the discharge becomes of a bad quality; the fragments of bone lie surrounded with the matter, and have not the least tendency to unite; the patient is attacked with hectic fever, and a colliquative diarrhoea. Under these circumstances, life may sometimes be preserved by amputation.

Fourth case. Bad State of the Stump. In hospitals, as Baron Larrey observes, the cure

of amputations is sometimes prevented by a fever of a bad character. The stump swells, the integuments become at first retracted, and then reverted and diseased a good way upward. The wound changes into a fungous ulcer, the cicatrization of which is hindered by the deep disorder of the bone, and the ulceration of the soft parts. The extremity of the bone projects. In order to remedy this last evil, it has been proposed to saw off the projecting part of the bone, and with this, even to amputate all the flesh beyond the level of the skin. Larrey condemns such practice, as unnecessary and dangerous, and he recommends giving nature time to effect the exfoliation of the diseased projecting part of the bone, and heal the wound. (See *Mémoires de Chir. Militaire*, T. 2.)

GUNSHOT WOUNDS OF THE ABDOMEN.

These cases may be divided into two kinds; one only penetrates the parietes of the belly, without hurting the contained parts; the other does mischief also to the viscera. The event of these kinds of wounds is very different. In the first, little danger is to be expected, if properly treated; but, in the second, the success will be extremely uncertain, for in many instances, nothing can be done for the patient, and on other occasions, a good deal of art may be employed with advantage.

It is observed by Mr. Hunter, that such wounds of the abdomen, as do not injure parts like the stomach, intestines, bladder, ureters, gall-bladder, large blood-vessels, &c. all which contain particular fluids, will generally end well. But he adds, that there will be a great difference, when the ball has passed with immense velocity, as a slough will be produced; whereas, when the ball has moved with less impetus, there will not be so much sloughing, and the parts will, in some degree heal by the first intention. Even when the ball occasions a slough, the wound frequently terminates well, the adhesive inflammation taking place on the peritoneum, all round the wound, so as to exclude the general cavity of the abdomen from taking part in the inflammation. Such is often the favourable event, when the ball, besides entering the abdomen, has wounded parts like the omentum, mesentery, &c. and gone quite through the body. (Hunter on *Inflammation*; *Gunshot Wounds*, &c. p. 543.)

In gunshot wounds of the belly, an extravasation is apt to take place on the sloughs becoming loose, about eight, ten, twelve, or fourteen days after the accident; but, says Mr. Hunter, although this new symptom is in general very disagreeable, most of the danger is usually over, before it can appear.

In the article *Wounds*, I have detailed at large the general principles, which should be observed in the treatment of wounds of the belly; consequently, it would be superfluous here to go over the whole of this extensive subject again. As a modern writer observes, "In their treatment, the violence

of symptoms is to be combated more by general means, than by any of the mechanical aids of surgery. The search for extraneous bodies, unless superficially situated, is altogether out of the question, except they can be felt by the probe, as in Ravaton's case, (*Chir. d'Armée*, p. 241,) or in other cases of lodgment in the bladder, where they may become the object of secondary operations. Enlargement, or contraction of the original wound, as the case may require, for returning the protruded intestine, securing the intestine itself, and promoting the adhesion of the parts, are all that the surgeon has to do in the way of operation; and even in this, the less he interferes the better. Nature makes wonderful exertions to relieve every injury inflicted upon her, and they are often surprisingly successful, if not injudiciously interfered with. In a penetrating wound of the abdomen, whether by gunshot, or by a cutting instrument, if no protrusion of intestine take place, (and this it must be observed, in musket or pistol wounds rarely occurs,) the lancet, with its powerful concomitants, abstinence and rest, particularly in the supine posture, are our chief dependence. Great pain and tension, which usually accompany these wounds, must be relieved by leeches to the abdomen, (if they can be procured) by topical application of fomentations, and the warm bath; and, if any internal medicine is given as a purgative, it must, for obvious reasons, be of the mildest nature. The removal of the ingesta, as a source of irritation, is best effected, by frequently-repeated oleaginous clysters;" (see *Hennen's Principles of Military Surgery*, p. 401. *Ed. 2.*) and with respect to dressings, "as the same author has observed, concerning cases, in which a ball has passed directly through the abdomen, the mildest applications should be employed, and no plugging with tents, nor introduction of medicated dressings thought of. (P. 406.) In this publication may be found cases, in which musket balls were passed by stool; (p. 404,) in which an artificial anus was formed; (p. 407, &c.) or the kidneys, liver, (p. 430—432,) diaphragm, (p. 437,) and other viscera, injured.

The following case exhibiting the possibility of recovery, though the small intestine be completely severed with a ball, is interesting, particularly as cases of this kind have been regarded as positively fatal. The success was also obtained, notwithstanding the treatment appears to have been rather too officious, especially in regard to four incisions made in the end of the bowel, when one would have removed the constriction spoken of.

At the assault of Cairo, 1799, M. N. was shot in the abdomen with a ball, which divided the muscular parietes of this cavity, on the right side, and a portion of the ileum. Larrey being upon the field of battle, gave him the first assistance. The two ends of the intestine protruded in a separated and inflated state. The upper end was everted, in such a way that its contracted edge, like the prepuce in a case of paraphimosis, strangu-

lated the intestinal tube. The course of the feces was thus obstructed, and the contents of the bowel accumulated above the constriction.

Although the patient's recovery was nearly hopeless, both from the nature of the wound, and from the debility and cholera morbus, which had already seized him in the short period that he remained without succour in one of the entrenchments, Larrey was desirous of trying what could be done for so singular a case. He first made four small cuts, through the constricted part of intestine, with a pair of curved seissors, and put the bowel into its ordinary state. He passed a ligature through the piece of the mesentery, corresponding to the two extremities of the bowel. These he reduced as far as the margin of the opening which he had taken care to dilate, and the dressings having been applied, he awaited events. The first days were attended with alarming symptoms, which, however, afterward subsided. Those which depended upon the loss of the alimentary matter, successively abated; and, after two months, the ends of the ileum were opposite to each other, and disposed to become connected together. Larrey seconded the efforts of nature, and dressed the patient with a tampon, or sort of tent, that was occasionally employed for two months. The patient was then discharged from the hospital quite cured.

In several instances, says Larrey, the sigmoid flexure of the colon was injured, and yet the wounds were cured without any fecal fistulæ. At the siege of Acre, three examples occurred; and at that of Cairo, two. Larrey dilated the entrance and exit of the ball. Clysters, made of the decoction of linseed, and emollient beverages were frequently exhibited; and the patients were kept on a low diet, and in the most quiet state.

Sword wounds, and those made with the bayonet, or lance, may injure some part of the bladder, or even pass through both sides of this organ. In the latter case, the injury is usually fatal, as the urine escapes from the inner wound into the abdomen, and immediately excites mortal inflammation. Baron Larrey dressed on the field of battle several soldiers, whose bladders were thus completely transfixed, and who all perished of inflammation and gangrene, within the first forty-eight hours. However, he observes, that if the weapon enter the bladder at that part of its fundus, which is not covered by the peritoneum, the case is curable, unless complicated with too much internal hemorrhage.

The surest criterion of these cases is the escape of the urine from the external wound; and its discharge may either be momentary, occasional, or continual; differences to be accounted for by the situation of the wound, and the changes which happen in the bladder. When the bladder is full, and its upper part is pierced, the urine will issue only just at the moment of the accident, and, as soon as it is discharged, the edges of the wound will come together, and permanently close, espe-

cially if the urine can pass freely through the natural channel. But when this favourable condition is absent, the bladder becomes enormously distended again, the wound is opened anew, and the urine discharged once more from the external opening. The same things might happen, if one were to withdraw too soon the elastic gum catheter, which has been introduced; and by introducing the instrument again, the urine might be diverted from the wound, and its natural course re-established. Lastly, Larrey observes, that when the wound is situated at one of the lowest points of the bladder, the discharge of urine may be incessant, and be of more or less duration.

When the track of these punctured wounds is extensive, and not direct, abscesses form at different points where the urine passes. These abscesses, Larrey directs to be immediately opened, and their recurrence prevented by the introduction of an elastic gum catheter through the urethra; one of the chief means of relief in all wounds of the bladder. Together with this treatment, he recommends the warm bath, the application of camphorated oily liniments to the belly, antispasmodic cooling medicines, frequent clysters, and sometimes cupping in the vicinity of the wound, or bleeding. (See *Mém. de Chir. Mil. T. 4, p. 286, 287.*) On the last means of relief, it would have been better if Larrey had laid more stress; for, next to the catheter, they are unquestionably the most essential.

Baron Larrey informs us, that the gunshot wounds of the bladder, which occurred in Egypt, had for the most part a favourable termination. The most remarkable case was that of F. Chaumette, a light horseman, who was wounded at the battle of Tabor. The ball passed across the hypogastrium, about one finger breadth above the pubes, to the point of the left buttock, which corresponds to the ischiatic notch. The direction of the wound and the issue of feces and urine from the two orifices left no doubt, that the bladder and rectum were injured. M. Miliot, who directed the surgical affairs of the division of the army under Kleber, diligently pursued the same kind of treatment which he had seen Larrey adopt at the siege of Acre. During the suppurative stage, the patient was affected with fever; and, after the sloughs were detached, the discharge was very copious. A catheter, that was passed into the bladder, prevented an extravasation of the urine, and at the same time, promoted the union of the wound of that viscus. This was healed the first, and the patient, upon his return to Cairo, was quite cured.

Larrey has recorded several other interesting cases of wounds, either of the bladder alone, or of it and the rectum together, to which I must content myself with referring. (See *Mém. de Chir. Militaire, T. 2, p. 160—165. T. 3, p. 340, &c. T. 4, p. 296, &c.*)

A ball may go through both sides of the bladder, and then either perforate the neigh-

bouring parts, and escape externally, or bury itself deeply in the flesh. When it has gone quite through the bladder, and afterward passed out of the body again, urine, blended with blood, immediately issues from one or both apertures, according to their situation. The flow of urine through the urethra is either lessened, or completely suppressed; but through this passage, the patient generally voids more or less blood. Acute and incessant pain is felt in the course of the wound, together with a frequent painful desire to make water, nausea, sometimes actual vomiting, and extreme anxiety, and restlessness. Either in its passage inwards, or its course outwards, the ball may have injured, or perforated the rectum, in which case, the urine passes into this bowel, and mixing with the feces, is discharged from the anus.

When a part of the bladder, towards the cavity of the abdomen, is injured, as for instance, its posterior surface which is covered by the peritoneum, the urine is generally extravasated within the belly, and inflammation of the preceding membrane is the immediate consequence. This inflammation spreads with rapidity, and attacks all the viscera, producing vast distention of the abdomen, fever, coma, and other bad symptoms, soon terminating in gangrene and death. (*Larrey, Mém. de Chir. Mil. T. 4, p. 292, 93.*)

During the first four and twenty hours, very little urine escapes from gunshot wounds of the bladder, in consequence of the swelling, which almost instantly affects the lips of the wound. When the bladder is full, this fluid is discharged only at the moment of the accident, and mostly only from the wound, by which the ball has made its exit. An extravasation is prevented by the thick slough, which fills all the track of the injury, and it is not till the deadened parts become loose, that any effusion can happen. Hence, it is of the highest importance to introduce an elastic gum catheter into the urethra, where it should be kept, and the instrument should be large enough to fill exactly this canal; for, according to Baron Larrey's observations, if at the period, when the sloughs are detached, the urine has not a ready passage outward, it passes through the wound, and is extravasated the more readily, inasmuch as the separation of the sloughs has occasionally many openings, by which the fluid may insinuate itself into the cellular membrane. Hence, gangrenous mischief and death.

On two points, my own experience would not lead me to join in the sentiments of Larrey: first, in opposition to his statement, I am sure, there is risk of extravasation of urine earlier than the period which he specifies, having known this accident commence as it were within a few hours after the receipt of the wound; and therefore, I should not depend upon the sloughs being always at first a complete barrier to extravasation of urine, (indeed, their formation throughout the whole track of a gunshot wound is by

no means a regular occurrence,) but invariably pass a catheter as soon as possible, for the more certain prevention of this dangerous consequence. Secondly, the period of the separation of sloughs may, indeed, often be contemporary with the first appearance, or symptoms of extravasation, particularly in cases where the employment of the catheter is for some time deferred, as in Baron Larrey's practice, because then a partial extravasation of the urine, soon after the injury, and previous to the introduction of the catheter, will cause rapid sloughing, and actually prevent the adhesive inflammation from closing up the cavities of the cellular membrane in time to prevent a fatal extension of that irritating fluid among the surrounding parts. Were it not for the partial early effusion of urine, no doubt the adhesive inflammation would, in these cases, soon have the same effect, in obviating the danger of urinary extravasation, which it has after lithotomy, or paracentesis of the bladder. (See *Bladder*.)

It is the practice of Baron Larrey to dilate the wounds, in order to facilitate the escape of the urine, which might otherwise lodge in the track of the ball; and perhaps, here the method may frequently be right, though I should conceive its propriety must usually depend upon whether the urine has a tendency to continue to flow out through the wounds, or not, and upon the presence of obstruction, or not. And in confirmation of this opinion, I may cite Dr. Hennen's declaration, that in these cases, he has very rarely found it necessary to enlarge the wound, when the catheter and proper dressings have been employed. (*On Military Surgery*, p. 421, Ed. 2.) And as soon as possible, a large elastic gum catheter should be introduced, and left in the urethra, taking care to withdraw it, and pass in a clean one every two or three days, so that no incrustations may occur. Sometimes, however, the passage of a catheter is very difficult, as is the case, when there are splinters of bone in the urethra, or the parts about the neck of the bladder are inflamed. (*Mém. de Chir. Militaire*, T. 4, p. 294.) Emollient clysters, and acidulated demulcent drinks are to be prescribed, and the patient is to be kept upon a very low regimen, and in the most quiet state. The dressings are to be light and simple, and cleanliness observed. (*Op. cit.* T. 2, p. 165—170.) Instead of camphorated embrocations to the abdomen, another means commended by Larrey, it appears to me, that this author's directions would have been more complete and judicious, had he advised in these cases bleeding, both topical and general.

From the injury of arterial ramifications, or varicose vessels, blood is sometimes extravasated within the wounded bladder, and causes deep-seated irritation. According to Baron Larrey, the case is indicated by the symptoms of retention of urine, and those of inflammation, with a small pulse, pallor of the countenance, and dryness of the wounds. (T. 4, p. 295.) A more decided

criterion, I should think, would be the partial escape of urine mixed with blood, a symptom, which could deceive only where the urethra itself had been injured. Larrey states that blood, extravasated in the bladder, rarely coagulates, because blended with urine, and hence, he advises its discharge to be facilitated by means of a catheter, and tepid, emollient, anodyne injections. (T. 4, p. 295.)

Sometimes balls carry before them into the bladder, fragments of bone, small coins, pieces of buttons, &c. or bits of bullets break off, and lodge in that viscus. When these extraneous bodies are not above a certain size, they are frequently voided through the urethra, (see *Cases in Dr. Hennen's Work*, p. 419, 422, 424, &c. Ed. 2,) and their evacuation may be materially facilitated by the introduction of an elastic gum catheter, the size of which is to be increased gradually, until the largest can be passed, when the foreign substances will readily enter the tube, or pass out through the dilated urethra. In this way, Baron Larrey has saved gravel patients from a vast deal of suffering. (*Mém. de Chir. Mil.* T. 4, p. 302.) When the ball is too large to be taken out in this manner, the lateral operation is to be performed, and it ought to be done before the bladder falls into an ulcerated, or gangrenous state from the pressure and irritation of the foreign body. However, as wounds of this organ frequently give rise to dangerous inflammation, Larrey recommends this operation, (and not that above the pubes, as is stated by mistake in Dr. Hennen's valuable book, p. 428, Ed. 2,) to be done either before its attack, or not till after its subsidence. (*Vol. cit.* p. 309.) In fact, almost all the operations of this kind on record have been done some considerable time after the receipt of the wound, and to this practice my own judgment would lead me to give a general preference. In one case, however Larrey operated on the fourth day after the receipt of the wound, and with success.

After the battle of Waterloo, I was not a little surprised to find in the St. Elizabeth hospital at Brussels, a considerable number of cases, in which either the intestines, the stomach, the omentum, or the bladder, protruded. I think we had in the division under Mr. Collier and myself, not less than three protrusions of the bladder. An order, which I received to join the army in the field on the 27th of June, deprived me of the opportunity of witnessing the progress and termination of these interesting cases. However, many had ended fatally before my departure from Brussels.

GUNSHOT WOUNDS OF THE THORAX.

Wounds of the lungs, abstracted from other mischief, are now well known not to be always fatal. Balls have been found in the substance of the lungs after having lodged there twenty years, during all which time the patients were healthy, and free from symptoms indicative of the case.

(*Percy, Manuel, &c. p. 25.*) Mr. Hunter had some reason to believe, that wounds of the lungs, made with balls, were generally less dangerous than such as were made with sharp-pointed instruments; for he had seen several patients recover after they had been shot through the lungs, while other persons died of very small wounds of those organs, done with swords and bayonets. Perhaps, one cause of this fact may be owing to the circumstance of gunshot wounds generally bleeding less than other wounds, so that there is not so much danger of blood being effused in the cavity of the chest, or the cells of the lungs. The indisposition of the orifice of a gunshot wound to heal up too soon, is also another circumstance that must lessen the hazard, as whatever matter happens to be extravasated has thereby an opportunity of escaping.

But from what has been stated, it must not be inferred, that gunshot wounds of the lungs are not accompanied with a serious degree of danger. Frequently the patient expires instantly, being suffocated in consequence of profuse hemorrhage from those organs; for though it be true, that gunshot wounds generally do not bleed much, when the injured vessels are under a certain size, yet the contrary is the case, when the wounded vessels are like those situated towards the root of the lungs. Gunshot wounds of the chest also often prove fatal by the inflammation that is excited within this cavity.

Appearances sometimes create a belief, that a ball has passed completely through the chest and lungs, when the fact is otherwise. "Thus (as Dr. Hennen observes,) I have traced a ball by dissection, passing into the cavity of the thorax, making the circuit of the lungs, penetrating nearly opposite to the point of entrance, and giving the appearance of the man having been shot fairly across, while bloody sputa seemed to prove the fact, and in reality, rendered the same measures, to a certain extent, as necessary as if the case had been what was suspected. The bloody sputa however, were only secondary, and neither so active and alarming as those which pour out at once from the lungs when wounded." (*Military Surgery, p. 368, Ed. 2.*) A second cause of deception is the frequent long course of a ball, round the chest under the skin and muscles, previously to its exit, whereby an appearance is presented, as if the patient had been shot through the thorax. And another source of deception, as to the actual penetration of balls, is "where they strike against a handkerchief, linen, cloth, &c. and are drawn out unperceived in their folds, a peculiarity which has not escaped M. Larrey, who gives an interesting notice on it in the *Bulletins de la Faculté de Méd. Paris*, 1815, No. 2. I have also given an instance in the preceding pages." (*Hennen loco cit.*) In these cases, the absence of bloody expectoration directly after the injury, the undisturbed state of respiration, and the greater freedom from oppression, anxiety, syncope,

and other bad symptoms, than in cases where the lungs are hurt, form grounds for a correct opinion on the true nature of the accident.

It cannot be supposed, that adhesions always take place round the opening of a gunshot wound in the chest, because the lungs must sometimes collapse, and become considerably distant from the pleura, especially when the communication established between the atmospheric air and the cavity of the thorax is very free and direct. However, as adhesions are extremely common between the outer surface of the lungs, and the inner surface of the pleura costalis, they must, in many instances, exist before the receipt of a wound, and of course, prevent the usual collapse of the lungs.

As the general symptoms and treatment of wounds of the chest, are detailed in the article *Wounds*, I shall not here detain the reader long upon this subject. When a patient has been shot in the chest, the most important indication is to prevent and subdue inflammation of the lungs and pleura. In few other cases can repeated and large bleedings be so advantageously practised. Here there will not be so much danger of an extravasation of blood as in stabs, and even if an effusion of that fluid were to happen within the cavity of the pleura, the opening would generally be sufficient for its escape, and it would not be so frequently found necessary to dilate the wound, or make a new opening, as when the injury has been inflicted with a sharp-pointed weapon.

In this last kind of case, when attended in the beginning with bleeding, Baron Larrey particularly insists upon the advantage of immediately bringing the edges of the wound together with adhesive plaster, instead of leaving it open, as advised by the generality of writers; and he endeavours to prove, that this immediate closure of the wound has great effect in stopping the hemorrhage from the pulmonary vessels. Supposing an extravasation of blood in the chest were to follow, he argues that it would be better to let it out afterward by a suitable incision, than to suffer the patient to perish of hemorrhage at once, by not closing the wound. (*Mem. de Chir. Mil. T. 4, p. 151, &c.*) Dr. Hennen is in favour of the same practice. (*On Military Surgery, p. 373, Ed. 2.*) In a penetrating gunshot wound of the chest, after taking away from thirty to forty ounces of blood, the surgeon should extract all extraneous substances, and splinters of bone within reach, and even dilate the external wound for this purpose, if necessary. Light unirritating dressings are then to be applied. The patient may now be (comparatively speaking) easy, until the spitting of blood, and danger of suffocation, from inward hemorrhage, come on again, when the lancet must be again employed; "and if by this management, repeated as often as circumstances demand, the patient survives the first twelve hours, hopes may begin to be entertained of his recovering from the immediate effects of hemorrhage," and, until this danger is over,

as Dr. Hennen truly observes, the lancet is the only thing which can save life. Afterward, when the paroxysms of pain, the sense of suffocation, and the return of hemorrhage have become more moderate, digitalis may be prescribed with the most beneficial effect; and if the cough be very troublesome, no medicine is more useful than the spermaceæ mixture with opium. With this treatment must be combined the exhibition of saline purgatives, mild laxative clysters, and a strictly low diet, the patient being allowed only slops. (See Hennen's *Military Surgery*, p. 373. Ed. 2.)

When matter forms in the thorax, in consequence of gunshot wounds, the opening will generally suffice for its escape; but should the collection of pus be confined, and occasion dangerous symptoms, the external wound must either be enlarged, or a new incision practised, according as circumstances may indicate. The mode of making an opening into the chest is considered in the article *Paracentesis*.

When a ball lodges, without falling into the chest, it may lie either in the substance of the parietes of this cavity between the muscles, or in one of the intercostal spaces, and continue there a very long time without causing much inconvenience, or making its way outward. But when it is lodged in the thoracic cavity itself, it descends by its weight, and sometimes excites considerable irritation, suppuration, sinuses, and hectic symptoms: in this case, if its situation can be ascertained, Baron Larrey recommends an attempt to extract it. In an early stage of the case, he says, that the intercostal space will often be wide enough to let the ball pass through it; but that, at a later period, this space becomes too narrow, and it will be necessary to cut away a portion of the upper edge of the rib with a lenticular knife, which is to be preferred to a trephine, or saw. This advice is supported by some very interesting cases. (See *Mem. de Chir. Mil.* T. 4, p. 253.) Frequently the ball fractures the rib, and with the aid of dilatation, sufficient room for its extraction may be made; but the possibility and propriety of removing it through the original opening will, of course, depend upon the situation of the foreign body, and the urgency of the symptoms. A case is recorded, in which a ball, weighing three ounces and a half, was thus removed. (*Med. and Surg. Journ.* Vol. 3, p. 353.)

Alphons. Ferrius de *Sclopetorum, sive Archibutorum Vulneribus*, &c. 8vo. Romæ, 1552. J. F. Rota de *Belllicorum Tormentariorum Vulneribus et Curatione*, 4to. Bonon. 1555. Botallus de *Curat. Vulner.* 1565. Wm. Clowe's *Approved Treatise for all young Chirurgians concerning Burnings with Gunpowder, and Wounds made with Gunshot*, &c. 4to. 1591. J. Quercetanus, *Sclopetarium, sive de curandis vulneribus quæ sclopetorum et similibus tormentorum ictibus acciderunt*, 8vo. 1591, 12mo. Leips. 1614. Fr. Plazzonus, de *Vulneribus Sclopetorum*, &c. 4to. Venet. 1618. J. Woodall, *Viaticum*, fol. Lond. 1639. H. F. Le Dran, *Traité*

ou *Réflexions tirées de la Pratique sur les Plaies d'armes à feu*, 2de Ed. 12mo. Paris, 1740. Desport, *Traité des Plaies d'armes à feu*, 12mo. Paris, 1749. Ranby's *Method of treating Gunshot Wounds*, 12mo. London, 1781. *Observations sur des Plaies d'armes à feu, compliquées de fracture, aux articulations des extrémités, ou au voisinage de ces articulations*, par M. Boucher, in *Mem. de l'Acad. de Chirurgie*, T. 5, p. 279, Edit. in 12mo. *Observations sur des Plaies d'armes à feu compliquées sur tout de fracas des os*, par M. Boucher, in *opere cit.* T. 6, p. 109. &c. Edit. in 12mo. *Observations sur les Plaies d'armes à feu*: 1. Sur un coup de fusil, avec fracas des deux machoires; par M. Cannac. 2. Sur une Plaie d'arme à feu traversant la Poitrine d'un côté à l'autre; par M. Gerard. 3. Sur une Plaie d'arme à feu, pénétrante depuis la partie antérieure du pubis, jusqu'à l'os sacrum; par M. Andouillé. 4. Sur une Jambe écrasée par un Obus, ou petite bombe, par M. Cannac. 5. Sur une Plaie à la partie inférieure et interne de la Jambe faite par un éclat de Grenade, sans fracas d'os; par M. Cannac. 6. Précis de plusieurs Observations sur les Plaies d'armes à feu en différentes parties; par M. Bordenave. All these papers are inserted in *Mém. de l'Acad. de Chirurgie*, T. 6, in 12mo. and in T. 11 of the same edition, are inserted *Mémoire sur le traitement des plaies d'armes à feu*, par M. de la Martinière, & *Mémoires sur quelques particularités concernant les Plaies faites par armes à feu*, par M. Vacher. M. Faure's *memoirs relative to amputation in cases of gunshot wounds* may be seen in T. 8 of the *Recueil des Pièces qui ont concouru pour le Prix de l'Acad. de Chirurgie*, Edit. in 12mo. John Hunter's *Treatise on the Blood, Inflammation, and Gunshot Wounds*. Richter, *Anfangsgrunde der Wundarzneikunst*, B. 1. Schmucker, *Vermischte Chir. Schriften*, 3 vols. 8vo. Berlin, 1776, 1782. *Chirurgische Wahrnehmungen*, 2 vols. Berlin, 8vo. 1744, 89; works of high value. *Discourses on the Nature and Cure of Wounds*, by John Bell, p. 169, &c. Edit. 3. Richerand, *Nosographie Chir.* T. 1. Edit. 4. Chevalier's *Treatise on Gunshot Wounds*, Edit. 3. Leveillé's *Nouvelle Doctrine Chirurgicale*, Tom. 1, Chap. 8, p. 436, &c. *Encyclopédie Méthodique, Parti Chir. art. Plaies d'armes à feu*. Larrey, *Mémoires de Chirurgie Militaire*, 4 Tom. 8vo. Paris, 1812, 1817; on the whole the most instructive book for army surgeons ever published, *Mémoire par M. De Conte, Prix de l'Acad. T. 8. Examen des plusieurs Parties de la Chirurgie*, par M. Bagieu, à Paris, 1756. Belguer's *Dissert. de Membrorum Amputatione rarissime administranda, aut quasi abroganda*; Halæ, 1761. This work is celebrated as having attracted most deservedly the just and severe criticisms of Pott, La Martinière, Morand, &c. Morand's *Opusculs de Chirurgie*, 1768. Van Gesscher, *Abhandlung Von der Nothwendigkeit der Amputation*; Freyburgh, 1775. M. G. Dignan, *Reflexions Importantes sur le Service des Hospitalaux Militaires*, 8vo. Par. 1785. Mursinna, *Neue Medicinisch-Chirurgische Beobachtungen*, Zweiter, Theil. S. 138. Berlin, 1796. Wedekind's *Nachrichten über das Fränsische*,

Kriegspitalwesen, *Erster B. Leipzig, 1797.* Baron Percy, *Manuel du Chirurgien d'Armée, Svo. Paris, 1792.* Paroisse, *Opusculs de Chir. Svo. Paris, 1806.* Graefe, *Normen für die Ablösung Grösserer Gliedmassen, Alo. Berlin, 1812.* Assalini, *Manuale di Chirurgia, Svo. Milano, 1812.* Guthrie on Gunshot Wounds of the Extremities, London, 1815; or the 2d Ed. entitled a Treatise on Gunshot Wounds, &c. Svo. London, 1820; a work detailing the practice of our military surgeons during the late war in Spain, and replete with valuable information. Thomson's Report of Observations made in the military hospitals in Belgium, Edinburgh, 1816. A. C. Hutchinson's Practical Observations in Surgery, 1816; and Further Obs. on the Period for amputating in Gunshot Wounds, Svo. Lond. 1817. Millengen's Manual, Svo. Lond. 1819. J. Hennen's Principles of Military Surgery, 2d Ed. Svo. Edinb. 1820; a publication which I cannot too strongly recommend, not only to army and navy surgeons, but to practitioners in general. James Mann, *Medical Sketches of the Campaigns of 1812, 13, 14; to which are added, Surgical Cases, Obs. on Military Hospitals and Flying Hospitals attached to a moving Army, &c. Svo. Dedham, 1816.*

GUTTA SERENA. A term said to have been first applied by Actuarius to amaurosis, or the species of blindness arising from a morbid state of the retina, or optic nerve. (See *Amaurosis*.)

In the present place, I mean first briefly to advert to a case, which the late Mr. Ware has described as combined with a particular kind of ophthalmia, that occasions excruciating pain, and requires peculiar treatment. One example of this kind was greatly relieved by a puncture, made through the tunica sclerotica into the ball of the eye with a grooved needle, somewhat larger than a common sized couching needle, nearly in the part where this instrument is introduced in the operation of depressing the cataract. Through the groove of the instrument, a watery fluid immediately issued, which was not unlike that which Mr. Ware several times found, after death; effused between the choroid coat and retina, in cases of gutta serena. After the pain of the operation had ceased, the patient became quite easy, and the inflammation soon subsided. Mr. Ware afterward performed a similar operation in a considerable number of resembling instances, and in several of them the proceeding was attended with almost immediate good effect. (See *Ware on the operation of largely puncturing the capsule of the crystalline humour, &c. and on the Gutta Serena, accompanied with pain and inflammation, 1812.*)

Under the head of gutta serena, I promised to notice Beer's opinions concerning amaurotic remedies, which, whether employed upon rational or upon empirical principles, he divides into two classes, viz. general, or internal means; and local, or external. Sometimes only the first are requisite; more rarely only the second; but frequently both together.

Amongst the internal remedies are eme-

tics, which may be useful in two ways, either as real evacuates, or as nauseating means. It is the opinion of Professor Beer, that for the purpose of exciting actual vomiting, they should be exhibited only when the stomach is foul, and no considerable plethora exists; and he deems them improper whenever a great determination of blood to the head and eyes prevails, or any increased velocity of the circulation. Should the surgeon find it necessary to employ emetic medicines, simply as alteratives, he must consider well whether the digestive organs will bear their great and long-continued operation. (*Lehre von den Augenkr. B. 2, p. 463.*) Notwithstanding the favourable accounts given by Schmucker, Richter, and Scarpa, of the good effects of emetics in many cases of amaurosis abroad, this treatment has had but little success in England. Mr. Travers even declares that he does not recollect an instance of decided benefit from the emetic practice, although he has often fairly tried it. "The cases of gastric disorder, to which it is especially applicable, are most benefited by a long-continued course of the blue pill, with gentle saline purgatives and tonic bitters." (*Synopsis of the Diseases of the Eye, p. 304.*)

When the bowels are loaded, and there is frequent determination of blood to the head and eyes, and an accelerated circulation, and particularly if, after these effects, the sight is always manifestly worse, brisk purgatives may be prescribed. When, however, constipation has prevailed for a long time, drastic purgatives should not be exhibited before one or two loose motions have been procured with laxative clysters. Gentle aperients are more particularly indicated when the patient does not have a stool daily, and the evacuation is never made with ease, nor without considerable straining; when he often passes two or three days without any evacuation at all, circumstances sure to be followed by repeated determination of blood to the head and eyes, and other ill consequences, which, according to Beer, have a very prejudicial effect on amaurosis.

Beer is of opinion, that diaphoretics should be employed with great caution, because they are apt to bring on violent determinations of blood, and an accelerated state of the circulation; and they can only be employed with judgment, and a hope of benefit, when there are good grounds for believing that a previous stoppage of the cutaneous functions has had a real share in producing, or keeping up, the blindness. They are still more strongly indicated, when the cessation of those functions is, in some measure, evinced by the dry state of the integuments, wandering pains between the skin and muscles, and considerable melioration of the eyesight after the breaking out of any accidental perspiration. (*B. 2, p. 465.*)

Professor Beer thinks, that in amaurosis medicines for promoting the menstrual discharge are too often employed on empirical principles, to the serious detriment of the

patient, the cessation of this discharge being mostly regarded as the cause of the amaurosis, while, in reality, it is very seldom really so, both affections being dependent upon one and the same cause. Hence much circumspection, and the closest investigation, are necessary to trace the connexion between these morbid effects, and to ascertain when such medicines can be given without risk.

Still greater mischief results from the treatment of amaurotic children with anthelmintics; nay, Beer assures us, that he has seen numerous amaurotic boys and girls thus wrongly treated, who had not the slightest symptom of worms. However, when amaurosis is unattended with any leading indications, anthelmintics may be tried, for they are less injurious to the eyes than many other medicines, though, as they consist of drastic purgative means, they must soon occasion great debility.

According to Beer, when there is good ground for suspecting any thing syphilitic about the patient, mercurials may be given with great prospect of benefit. Also, when no suspicion of this kind can be entertained, but amaurosis is accompanied with infarction of the abdominal viscera, especially a manifest chronic disease of the liver, or serious chronic swellings and indurations of the glands, a periodical headach, of no determinate character in other respects, and aggravation of the blindness after every such attack, mercurial preparations, as Beer can assert from manifold observation, are productive of the best effects upon the disease of the eyes. Yet, says he, under these circumstances, mercury should never be exhibited where the individuals are of a debilitated scorbutic diathesis, or subject to bleedings, and more particularly where there is the least mark of a dissolution of the vitreous humour. (*Lehre von den Augenkr. B. 2, p. 466.*) Upon the whole, from what I am able to learn of the practice in London, mercury is more extensively and successfully used, as a remedy for amaurosis, than any other medicine in the whole pharmacopeia. "When the amaurosis is recent and sudden, (says Mr. Travers) and either the signs of an obscure inflammation are present, or only the amplitude and inactivity of the pupil correspond to the patient's history—mercury should be introduced with all convenient rapidity into the system, I mean so as to ruffle it in the least possible degree. No advantage is obtained by salivation; on the contrary, I think it hurtful: when mercury is beneficial, its efficacy is perceived as soon as the mouth is sore." (*Synopsis of the Diseases of the Eye, p. 305.*)

Anti-nervous medicines have, at all times, ranked very high, on empirical principles, as means for the cure of amaurosis; but, how often is this disease not simply a nervous affection? Beer divides the medicines of this sort, employed in cases of amaurosis, into three classes, namely, *antiparalytic*, *antispasmodic*, and *tonic*. To the first class be-

long arnica, naphtha, camphor, millepedes, sulphur auratum antimonii, liquor ammoniæ lavendulatus, pulsatilla, black hellebore, and phosphorus. These medicines can be safely given to amaurotic patients, when an evident general nervous debility, and morbid irritability prevail, without any other particular appearances of disease, and especially when, at the same time, there are genuine paralytic appearances in the eye itself, or in the parts immediately surrounding it, or not very far from it. Among the *antispasmodic* remedies, particularly when used on empirical principles, Beer has found the most efficacious to be valerian, liquor ammoniæ carbonatis, assafoetida, opium, hyosciamus, castoreum, musk, flores zinci, and extract of chamomile. Tonic nervous remedies, says Beer, are to be used with more caution; for bitter medicines, when injudiciously prescribed for nervous debilitated individuals, rather promote the formation of amaurosis. When calamus aromaticus is in question, care must be taken that there be no tendency to pectoral complaints, which this medicine is too apt to bring on in weak subjects; in which event the sight is always very much impaired by it. In costive habits, bark is likewise apt to render the blindness worse. And according to the same experienced oculist, it is necessary to be very circumspect with steel medicines, empirically prescribed, as they frequently occasion determinations of blood to the head and eyes, and quicken the circulation, whereby every remnant of vision may be abolished. Steel medicines do the greatest and quickest injury to amaurotic eyes, when combined with narcotics. Above all things, it is generally prudent, in cases of amaurosis, carefully to abstain from all the stronger and long-operating nervous medicines, whenever plethora, determinations of blood, and tendency to inflammation exist. (*Lehre von den Augenkr. B. 2, p. 467.*) In this country, I do not believe that antinervous and antispasmodic medicines have obtained credit for their efficacy in this disease. Thus, Mr. Travers states, that he has never known any real benefit derived from camphor, assafoetida, valerian, &c. though he has seen much good derived from tonics, the mineral acids, bark, steel, and arsenic, after a due regulation of the digestive functions. (*Synopsis, &c. p. 304.*) In arnica montana, aconite, euphrasia, and stimulants in general, he has no confidence.

Local, or external medicines, for amaurosis, are divided by Beer into two classes, namely, into those which are applied to parts more or less distant from the eyes, and having some sympathetic connexion with these organs; and into others, which are usually put upon the eye itself.

In the first class bleeding has obtained high repute, either by venesection in the common way, the application of leeches to the pudenda, the arms, behind the ears, or upon the temple; cupping the back, or by opening the temporal artery or jugular vein. Bleeding is indicated when manifest ple-

thora, a determination of blood to the head and eyes, or an accelerated circulation, is combined with a considerable decrease of vision; when the menses are nearly or quite suppressed in plethoric subjects; a manifest determination of blood to the parts of generation prevails; or the same thing occurs in hemorrhoidal patients. (Beer, *Lehre*, &c. p. 469.)

According to Mr. Travers, all the cases of direct debility, and proper paralysis of the optic nerve, are aggravated by loss of blood. (*Synopsis*, &c. p. 303.)

Professor Beer gives his testimony also, in favour of the efficacy of such applications as produce a counter-irritation, not merely as rubefacients, but as means occasioning an evacuation of lymph; such are blisters, sinapisms, laid on the back or calves of the legs, vesication by means of the bark of mezezon, issues, and setons. These means are proper when the blindness is attended with continual, but wandering pains in the aponeurotic covering of the head, or in the vicinity of the eye, with a whizzing noise and irritating pain in the ear, or with the suppression of a purulent discharge from the meatus auditorius. In such cases, however, there must be no particular plethora, still less any determination of blood to the head and eyes. Here should also be mentioned friction with antimonial ointment, which is especially indicated where there is reason to believe, that the amaurosis has been preceded, and partly produced, by a long interruption of the cutaneous secretion.

Formerly, according to Beer, clysters were too commonly employed in cases of amaurosis; for whenever the cause of the disease was not understood, it was usual to refer it to a morbid state of the abdominal viscera. At present, clysters in amaurotic cases are employed quite empirically, as stimulants to the intestinal canal, and evacuants, when the loaded state of the bowels and obstinate constipation require them, and when the scantiness and difficulty of the evacuations keep up a constant determination of blood to the head and eyes, and when perhaps for other reasons, common purgative medicines cannot be employed. Beer says that aperient clysters are attended with the most decided good effects in that amaurotic weakness of sight, which sometimes occurs towards the end of pregnancy, and is combined with obstinate constipation, continual headach, evident determination of blood to the head and eyes, and such an inflammatory diathesis as cannot be mistaken. On the other hand, the employment of clysters as anodyne remedies, not as evacuants, is principally useful in hypochondriacal and hysterical amaurotic patients, when they are troubled with much general cramp, and spasms in the abdomen. (*Vol. cit.* p. 470.)

According to the statements of the same writer, baths, whether warm or cold, adapted for the whole body, or in the form of a slipper-bath, a pediluvium, or effusion, have hitherto not proved very efficacious empiri-

cal remedies for amaurosis, and this, whether they consist of simple water, or aromatic decoctions, or of waters impregnated with sulphur or iron. The reason why baths in general are less frequently employed as empirical remedies in cases of amaurosis, and why they are still more rarely successful, may be, because in the very cases of amaurosis, in which baths of various kinds are clearly indicated, the greatest attention must be paid to the patient's constitution, to the state of the skin especially, and to the temperature of the fluid employed; for, in a healthy subject, too warm a bath may, under certain circumstances, (as for instance when there is plethora,) of itself occasion a serious aporetic amblyopia; and therefore, under similar circumstances, must be likely to increase any present amaurotic weakness of sight into complete blindness. In general warm whole, or slipper, baths must be employed as empirical remedies in amaurosis only when the regular action of the skin is disturbed, without febrile symptoms, when the affection of the eyes has been preceded by the sudden stoppage of a profuse perspiration; or some cutaneous efflorescence is coexistent with the amaurosis. On the contrary, pediluvia with salt, mustard, &c. are chiefly proper when amaurosis is accompanied with a determination of blood to the head and eyes, or any local inflammations, after which the eyesight is always found to be worse. In cases of amaurosis affusion can be seldom used empirically, and only under those circumstances where modern experience has proved the shower bath to be allowable. Cold bathing generally agrees badly with an amaurotic patient, and when his skin is extremely sensible, when wandering pains are felt between the integuments and muscles, or there is a tendency to erysipelatous inflammation, the power of vision evidently declines after every trial of the plan. But, according to Beer, mineral waters, impregnated with iron, in the form either of a bath for one half, or for the whole of the body, generally produce, under these circumstances, the most favourable effects upon the skin, and through the medium of it, upon the diseased eye. The case, however, is to be excepted where flying rheumatic, and perhaps gouty pains constantly tease the patient, unaccompanied with fever, and where bathing of the whole body in sulphurous mineral water should be preferred. (*Lehre von den Augenkr. B. 2, p. 471, 472.*)

If we are to believe Beer, the empirical employment of applications which have the effect of increasing the secretion of mucus, is very seldom proper, such as irritating gargles, the smoking of tobacco, and sternutatory powders; for these means can only be adopted with any prospect of benefit when amaurosis is accompanied with plethora, a sense of spasm and weight about the frontal sinuses, an incessant obtuse heaviness at the bridge of the nose, and unusual dryness of the nostril, in an individual, who has frequently suffered catarrhal complaints, but

Some time previously to the origin of the amaurotic symptoms has continued nearly, or quite free from colds; and when the patient has no tendency to plethora, determination of blood to the head and eyes, and acceleration of the circulation. (*Vol. cit. p. 473.*)

The application of sternutative powders to the nostrils is, perhaps, to be regarded as a mode of treatment, established on empirical principles, unless we can place confidence in the statement of Schmucker, Richter, and Beer, that an unusual dryness of the mucous membrane of the nose, following tedious and severe catarrhs, may have the effect of inducing amaurosis. The snuff employed by Schmucker, is thus composed: *R. Mercur. viv. ʒj. Sacchar. alb. ʒiij, Lill. Alb. Rad. Valerian. aa ʒj. Misce.*

The late Mr. Ware imputed considerable efficacy to electricity and a mercurial snuff in cases of gutta serena. The snuff was compounded of ten grains of turbith mineral (*hydrargyrus sulphuratus*) well mixed, with about a dram of the pulvis sternutatorius, glycyrrhiza, or common sugar. A small pinch of this snuff, taken up the nose, is found to stimulate it very considerably—sometimes exciting sneezing, but, in general, producing a very large discharge of mucus. (*See Chir. Obs. relative to the Eye, Vol. 1.*)

Among the remedies, which, in cases of amaurosis, are intended to be applied directly to the eye, and its surrounding parts, local bleeding merits the first rank. The extraction of blood, by means of leeches, is the only mode in which the practice can here be executed. The method, however, is only proper when manifest turgescence of the vessels of the conjunctiva and sclerotica is combined with a feeling of constant pressure about the eye, a sense of fulness and tension in the ball, and evident plethora, without any local inflammations or increase in the velocity of the circulation.

Experience proves also, says Beer, that the empirical application of rubefacients, or drawing plasters, to the temples, or eyebrows, is fraught with not less efficacy, when all sensibility in the retina appears to be extinguished, without any defect in the texture of the eye, any varicose dilatation of its blood-vessels, or any particular determination of blood to it. Applications, producing an evacuation of lymph, including both blisters and antimonial ointment, may be alternately employed upon the eyelids and temples, when there are grounds for believing, that the functions of the skin have already been long suspended by porrigo, or the stoppage of perspiration on the forehead. (*Beer, Lehre von der Augenkr. B. 2, p. 474.*)

As in the rational plan of treatment, the rubbing of fluid, pungent, or irritating medicines upon the eyebrows, in certain kinds of amaurotic blindness, is often attended with considerable efficacy; so, in Beer's opinion, it should not be neglected in cases where the surgeon is compelled to have re-

course to empirical methods of cure; for instance, where it is observable, that generally in the evening, or the shade, the eyesight immediately grows weaker; that, on the patient's first awaking in the morning, it is weaker than in the middle of the day; and what particularly merits notice, while the case is unattended with any sensations of imaginary flashes of light; a very feeble, or entirely abolished motion of the iris; not the least vestige of any defect in the structure of the eye; and no symptoms of determination of blood to the head and eyes, or of a general tendency to inflammation. Beer recommends pungent applications to be first tried; such as the spiritus aromaticus, balsamus vitæ Hoffmanni, or Cologne water. These may be followed by aqueous substances, naphtha, &c. then by narcotics, like the tincture of opium, and lastly, by irritating remedies, like the tinctura lyttæ. Fluid applications, which are applied in the form of vapour to the eye, demand greater circumspection, like naphtha, the liquor ammonia, &c. These may be best applied by putting a small quantity of them into the hand, over which the eye must be held in such a manner that none of the fluid will come into contact with it. But as soon as the eye begins to be irritated by the vapour, the tears to run, or actual pain is felt, the hand is to be removed, lest too much irritation be produced. (*Beer, Vol. cit. p. 475.*)

Not only in the empirical, but also in every scientific mode of treating amaurosis, says this author, such remedies, as are intended to produce a shock upon the nerves and vessels, require the utmost caution, because, of all the various classes of remedies, they are the most powerful; and consequently, if misapplied, are likely to convert an amaurotic weakness of sight into complete blindness. This mournful event is most rapidly produced, when applications of this description are employed in plethoric subjects, affected with partial determinations of blood and local inflammations, a varicose state of the blood-vessels of the eye, defects in the transparent media of that organ, or frequent headach. To this class of remedies belong especially the shower bath, electricity, galvanism, &c. On the empirical plan they can only be used with safety or advantage, when decided marks of paralysis, either in the amaurotic eye or its appendages, are present. (*Lehre von den Augenkr. B. 2, p. 477.*)

Mr. Ware has observed, that the pupil has been generally dilated in the cases benefited by electricity. He notices, however, that there are many instances, in which a contraction of the pupil is the only change which takes place in the appearance of the eye. In this sort of case, the impairment of sight is usually preceded by severe pain, and the original cause may be an internal ophthalmia of long continuance. The crystalline is sometimes visibly opaque. Here electricity has been found useful; but Mr. Ware states, that in these instances, the sublimate

has proved superiorly and more certainly efficacious, and, consequently, he prefers it to all external applications whatever. He recommends one-fourth of a grain, as a quantity proper for a common dose, and says, that it agrees best with the stomach when first dissolved, as Van Swieten directs, in half an ounce of brandy, and taken in a basin of sago or gruel. For young patients the dose must be diminished in proportion to their youth. The medicine is to be continued as uninterrupted as the constitution will allow, for a month, six weeks, or even longer.

Electricity is said to have proved more strikingly useful, in cases of amaurosis, originating from lightning, than when the disease has arisen from any other cause. Mr. Ware relates a most interesting instance of the success of electricity, in a case which came on very suddenly, after great pain in the teeth, and a swelling of the face, had gone off. The disorder came on more suddenly; the temporary blindness was more entire; the eyelids were more affected, and the cure more speedy, than in the instances related by Mr. Hey, in the 5th Vol. of the *Med. Obs. and Inq.* (*Chir. Observ. relative to the Eye, by J. Ware, Vol. 1.*) However, the amaurosis produced by lightning may also be sometimes cured in other ways. Mr. Wardrop mentions that he has only seen one case of this kind, and the sight was restored by the repeated application of small blisters over the frontal nerve. (*Essays on the Morbid Anatomy of the Human Eye, Vol. 2, p. 173.*)

With the exception of one case related by Valsalva, Scarpa was unacquainted with any instance of amaurosis, arising from a wound of the eyebrow, that was relieved, and he has, therefore, set down this species as incurable. The opinion, however, is not perhaps correct, for the first case related by Mr. Hey arose from this cause, and was cured by giving every night the following dose: *R. Calomel. pp Camphor. aa iij. Conserv. Cy-nosb. q. s. probe miscant et f. Bolus*, in conjunction with electricity. The lady, however, had been previously bled twice, had taken some nervous medicines, and had had a blister between the shoulders. The patient was first set upon a stool with glass

feet, and had sparks drawn from the eyes, and parts surrounding the orbits, especially, where the superciliary, and infra-orbital branches of the fifth pair of nerves spread themselves. After this operation had been continued half an hour, she was made to receive, for an equal time, slight shocks through the affected parts. In a few days sight began to return, and in less than three months it was quite restored:—In another case, one grain of calomel, and two of camphor, given every night, and the employment of electricity, effected a cure. The disease had come on gradually, without any previous accident, or pains in the head. The patient a boy nine years old.

There are several other very interesting cases of amaurosis related by Mr. Hey, all of which make electricity appear an efficacious remedy, though it is true, as Scarpa observes, that in most of these instances, internal medicines were also given, and bleeding occasionally practised. Mr. Hey attributes the benefit chiefly to the electricity, because, in two of his cases, no medicines were used, yet the progress of the amendment seemed to be as speedy in them, as in the rest, and in two instances, a degree of sight was obtained by the first application of electricity. At present, I think electricity and galvanism, as means of benefiting amaurosis, are now less valued in England than on the continent: Mr. Travers states, that he has had recourse to them in many cases, some of which were of a very favourable description, but he never saw any good produced by them. (*Synopsis of the Diseases of the Eye, p. 303.*)

How far, however, the statements of Beer, Ware, &c. about the efficacy of local applications can be trusted, is yet a question; for they disagree with reports made by other writers. Thus, with the exception of cupping, issues, setons, and particularly blisters, Mr. Travers declares, that his experience leads him to attach no value to the various forms of external remedies. (*Synopsis, &c. p. 30, 8vo. Lond. 1820.*)

In Dr. Vetch's *Practical Treatise on Diseases of the Eye, 8vo. Lond. 1820*, a work published since the article *Amaurosis* in this Dictionary was printed, the reader will find a chapter on this disease worthy of his attention. (See p. 133, &c.)

H.

HÆMATOCELE, (from *αἷμα*, blood, and *κελε*, a tumour. This is a swelling of the scrotum, or spermatic cord, proceeding from, or caused by, blood.

According to Mr. Pott, when the tunica vaginalis has been long, or much distended, "it becomes thick and tough; and the vessels (especially those of its inner surface) are sometimes so large as to be very visible, and even varicous. If one of these lies in the way of the instrument, wherewith the palliative cure is performed, it is sometimes wounded; in which case the first part of the

serum which is discharged, is pretty deeply tinged with blood.

"Upon the collapse of the membranes, and of the empty bag, this kind of hemorrhage generally ceases, and nothing more comes of it. But it sometimes happens, either from the toughness of the tunic, or from the varicose state of the vessel, that the wound (especially if made by a lancet) does not immediately unite; but continues to discharge blood into the cavity of the said tunic, thereby producing a new tumour, and a fresh necessity of operation."

This is what Mr. Pott calls the first species of hæmatocele, which evidently proceeds from a wound of a vessel of the vaginal tunic.

"Upon the sudden discharge of the fluid, from the bag of an over-stretched hydrocele, and thereby removing all counter-pressure against the sides of the vessels, some of which are become varicous, one of them will, sometimes without having been wounded, burst; (hence, the last running of the water from a hydrocele is often bloody.) If the quantity of blood, shed from the vessel so burst be small, it is soon absorbed again; and creating no trouble, the thing is not known. But if the quantity be considerable, it, like the preceding, occasions a new tumour, and calls for a repetition of the operation." This, Mr. Pott calls the second species: "which, like the first, belongs entirely to the vaginal coat, and has no concern either with the testicle, or with the spermatic vessels. In both, the bag which was full of water, becomes in a short space of time distended with blood; which blood, if not carried off by absorption, must be discharged by opening the containing cyst: but in neither of these can castration (though said to be the only remedy) be ever necessary: the mere division of the sacculus, and the application of dry lint to its inside, will, in general, if not always, restrain the hemorrhage, and answer every purpose, for which so severe a remedy has been prescribed." With respect to filling the cavity of the tunica vaginalis with lint, I believe few good surgeons of the present day would consider the measure at all necessary or proper. I have seen three or four cases of hæmatocele of the above kind laid open, but never knew the surgeon compelled by the bleeding to cram the tunica vaginalis with lint to the great irritation and injury of the testicle itself. On the contrary, after taking out the blood, letting the parts collapse, and applying the cold *lotio plumbi acetatis*, for a few hours to the scrotum, by means of linen wet with the application, they substituted for the lotion an emollient poultice, and had recourse to fomentations, saline purgatives, leeches, and even venesection, according to circumstances.

The next example, pretended by Pott and Richter, to be a form of hæmatocele, is not admitted by Richerand, Jourdan, (See *Dict. des Sciences Méd.* T. 20, p. 126.) and other modern surgeons.

"If," says Mr. Pott, "blood be extravasated within the tunica albuginea, or proper coat of the testicle, in consequence of a great relaxation, and (as it were) dissolution of part of the vascular compages of that gland, and the quantity be considerable, it will afford or produce a fluctuation, to the hand of an examiner, very like to that of an hydrocele of the tunica vaginalis; allowing something for the different density of the different fluids, and the greater depth of the former from the surface.

"If this be mistaken for a simple hydrocele, and an opening be made, the discharge

will be blood, not fluid, or very thin; not like to blood circulating through its proper vessels; but dark and dusky in colour, and nearly of the consistence of thin chocolate (like to what is most frequently found in the imperforate vagina.) The quantity discharged will be much smaller than was expected from the size of the tumour; which size will not be considerably diminished. When this small quantity of blood has been so drawn off, the testicle will, upon examination, be found to be much larger than it ought to be; as well as much more loose and flabby; instead of that roundness and resistance arising from an healthy state of the gland, within its firm strong coat, it is soft, and capable of being compressed almost flat, and that generally without any of that pain and uneasiness, which always attend the compression of a sound testicle. If the bleeding ceases upon the withdrawing the cannula (supposing a trocar to have been used) and the puncture closes, a fresh accumulation of the same kind of fluid is soon made, and the same degree of tumefaction is produced, as before the operation: if the orifice does not close, the hemorrhage continues, and very soon becomes alarming.

In the two first species, "the blood comes from the tunica vaginalis, the testis itself being safe and unconcerned; and the remedy is found, by opening the cavity of the said tunic; but in this the hemorrhage comes from the substance of the testicle: from the convolutions of the spermatic artery, within the tunica albuginea: the division of the vaginal coat can here do no good; and an incision made into the albuginea can only increase the mischief: the testicle is spoiled or rendered useless, by that kind of alteration made in it, previous to the extravasation; and castration is the only cure which a patient in such circumstances can depend upon."

I confess, that no good reason appears for arranging cases of the preceding kind with hæmatocele; for, what are they but diseased testicles? which have been punctured, either on account of their seeming to contain a fluid, or really having within them cysts filled with a chocolate coloured or other fluid, as I have seen in hundreds of instances of sarcocele, and, whatever blood is discharged, was not extravasated in the substance of the testes previously to the puncture, but issues as a necessary consequence of that proceeding. However, of the propriety of the practice advised by Mr. Pott, no doubt can be entertained.

"The last species of this disease, noticed by Mr. Pott, arises from a bursting of a branch of the spermatic vein, between the groin and scrotum, in what is generally known by the name of the spermatic process. This, which is generally produced by great or sudden exertions of strength, feats of agility, &c. may happen to persons in the best health, whose blood and juices are in the best order, and whose genital parts are free from blemish or disease.

"The effusion, or extravasation, is made

into the cellular membrane, which invests and envelopes the spermatic vessels, and has something the appearance of a true hernia. When the case is clear, and the extravasated blood does not give way to discutient applications, the only remedy is to lay the tumour fairly open, through its whole length. If the vessel or breach be small, the hemorrhage may be restrained by mere compression with dry lint, or by the use of styptics; but if it be large, and these means do not succeed, the ligature must be made use of."

I cannot conceive, that, in any case of a mere rupture of one of the spermatic veins, it can ever be justifiable to tie the whole spermatic chord, and then perform castration, though Mr. Pott advises this plan in case the bleeding branch cannot be tied singly. Discutient applications, and an occasional purge, will almost always disperse the swelling; and if not, opening it, taking out the blood, applying cold, or, if necessary, filling the cavity with lint, and using compression, would be, according to my humble judgment the most judicious treatment.

A case, precisely of the latter kind, is not very common, yet Mr. Pott has not omitted it, as one of the forms of hæmatocele; but, why he has not taken notice of the most frequent of all the varieties of this disease, I am at a loss to conjecture; I mean the extravasation of blood in the loose cellular membrane of the scrotum from blows on the part, and sometimes from lithotomy, castration, &c. quite unconnected with any rupture of the spermatic veins. These are the cases which are mostly met with in practice. I have seen them followed by suppuration; but, in general, the effused blood is gradually absorbed, with the aid of discutient applications, leeches, fomentations, poultices, and saline purges. A surgeon should generally be reluctant to lay open the tumour, as, in many instances, sloughing and very severe symptoms have been the result.

Celsus and Paulus Ægineta are the best of the old writers on hæmatocele. For modern information, consult Pott's Chir. Works, Vol. 2. B. Bell on Hydrocele. Flajani, Collezione d' Osservazioni, &c. T. 2; Richter, Anfangsgr. der Wundarzn. B. 6; Richerand, Nosographie Chir. T. 4; Oslander, in Arnemann's Magazin für die Wundarzn. 1 B. p. 355,—the patient died after an opening had been made in the swelling. Follet, in Journ. de Méd. continué, Vol. 13, p. 422,—a case from contusion, cured by an incision. Harris in Mem. of Lond. Med. Society, Vol. 5.

HARELIP. (*Labia Leporina.*) A fissure, or perpendicular division of one or both lips. The term has arisen from the fancied resemblance of the part to the upper lip of a hare. Occasionally the fissure is more or less oblique. In general, it is directly below the septum of the nose; but sometimes it corresponds to one of the nostrils. The two portions of the lip are generally moveable, and not adherent to the alveolar

process; in less common cases they are closely attached to the forepart of the jaw.

Children are frequently born with this kind of malformation, which is called a *natural* harelip, while that which is produced by a wound is named *accidental*. Sometimes the portions of the lip, which ought to be united, have a considerable interspace between them; while in other instances, they are not much apart. The cleft is occasionally double a little lobe, or small portion of the lip, being situated between the two fissures.

The fissure commonly affects only the lip itself, and usually the upper one. In many cases, however, it extends along the bones and soft parts forming the palate, even as far as the uvula; and sometimes those bones are entirely wanting.

A harelip, in its least degree, occasions considerable deformity; and when more marked, it frequently hinders infants from sucking, and makes it indispensable to nourish them by other means. When the lower lip alone is affected, which is rare as a malformation, the child can neither retain its saliva, nor learn to speak, except with the greatest impediment. The constant escape of the saliva, besides being an annoyance, is found to be detrimental to the health; for its loss impairs the digestive functions, the patient becomes emaciated, and even death would sometimes ensue, if the incessant discharge of so necessary a fluid in the animal economy were not prevented. Thus, a lady, who was in this state, consulted Tronchin, who immediately saw the cause of her indisposition, and recommended the fissure in the lip to be united; the operation was done, and the dyspeptic symptoms then ceased. And, when the fissure pervades the palate, the patient not only articulates very imperfectly, but cannot masticate, nor swallow, except with great difficulty, on account of the food readily getting up into the nose.

An early removal of the deformity must obviously be very desirable; but, as it cannot be accomplished without an operation, attended with some degree of pain, Dionis, Garengot, and others, advise waiting till the child is four or five years old, on the supposition, that, at an earlier age, the child's agitations and cries would render the operation impracticable, or derange all the proceedings taken to ensure its success. It is plain, however, that such reasons are not of great weight. A child four or five years old, and, very often, even one eight or ten years of age, is more difficult to manage, than an infant only a few months old. Every child of the above age has a thousand times more dread of the pain, than of the deformity, or of the inconveniences of the complaint, to which he is habituated; while an infant of tender years fears nothing, and only feels the pain of the moment.

A more rational objection is the liability of infants to convulsions after operations, and this has induced many excellent surgeons of the present day to advise postpo-

ning the cure of the harelip, till the child is about two years old. Perhaps, however, this apprehension does not vindicate quite so much delay.

Mr. Sharp observes, "there are many lips, where the loss of substance is so great, that the edges of the fissure cannot be brought together, or, at best, where they can but just touch; in which case, it need not be advised to forbear the attempt; it is likewise forbid in young children, and with reason, if they suck; but otherwise it may be undertaken with great safety, and even with more probability of success, than in others that are older." (*Operations in Surgery*, chap. 34.)

Le Dran performed the operation on children of all ages, even on those at the breast. B. Bell did it with success on an infant only three months old. Muys advises it to be undertaken as soon as the child is six months old. Roonhuysen operated on children ten weeks after their birth, and all his contemporaries have praised his singular dexterity and success. As an essential step to the success of the operation, the latter surgeon recommended hindering the children from sleeping a certain length of time before it was undertaken, in order that they might fall asleep immediately afterward; and with the same view, opiates have been prescribed.

Putting out of consideration the partial success, which has attended the use of blistering plaster for making the edges of the fissure raw and capable of union, all practitioners entertain the same sentiment, with regard to the object of this operation, which consists in reducing the preternatural solution of continuity to the state of a simple wound, by cutting off the edges of the separated parts throughout their length, and then keeping these parts in contact until they have completely grown together. But although such principles have been generally admitted, there was formerly some difference of opinion, with respect to the best method to be followed in practice; some operators having preferred sutures for keeping the edges of the wound in contact; while others disapproved of them, believing that a perfect cure might always be accomplished by means of adhesive plaster and an uniting bandage, so as to save the patient from all the pain and annoyance of sutures.

M. Louis thought, that the use of sutures, in the operation for the harelip, proceeded from a false idea respecting the nature of the disease; for the fissure in the lip being wrongly imputed to loss of substance, it was deemed impossible to keep the parts in contact, except by a suture.

"The separation of the edges of the fissure in the lip," says M. Louis, "is only the effect of the retraction of the muscles, and is always proportioned to the extent of the cleft. Persons with harelips, are capable of bringing the edges of the fissure together by muscular action, by puckering up their mouths. On the other hand, the separation is considerably increased when they laugh,

and the breach appears excessively large, after superficially paring off its edges on both sides. The interspace in the harelip must not, therefore, be mistaken for a loss of substance. This truth is confirmed by the effects of sticking plaster, which has sometimes been applied to the harelip, as a preparatory measure before the operation, and which materially lessens the separation of the parts.

"According to the confession of all who have written in favour of the twisted suture, it seems advisable only on the false idea, that the harelip is the effect of a greater or lesser loss of substance: and they say, positively, that we must not have recourse to it when there is only a simple division to be united. The twisted suture must then be proscribed from the operation for the natural harelip, since it is proved, that this malformation is unattended with loss of substance. At the same time, a loss of substance is but too real, after the extirpation of scirrhous and cancerous tumours, to which the lips are very subject. Yet, even in these cases, the extensibility of the lips allows an attempt to be made to reunite the double incision, by which the tumour has been removed, and it succeeds without the smallest deformity, when care is taken to direct each incision obliquely, so that both of them form, where they meet, an acute angle, in the base of which the tumour is comprised. Here the means of union ought to be the more efficacious, because the difficulty of keeping the edges of the wound approximated is greater. M. Pibrac in his memoir on the abuse of sutures, when speaking of the harelip, has already explained that they are badly conceived means, and more hurtful in proportion as there is a greater loss of substance, because the greater the interspace is between the two parts, the more fear is there of their efforts on the needles or pins left in the wound. Hence, care has always been taken to make the dressings aid the operation of the suture. After this consideration, judiciously made by the partisans of this plan, there was only one more step to be taken, according to M. Pibrac, in order to evince the necessity of proscribing it. The cap, or copper head-piece, described by Verduc and Nuck, for compressing the cheeks; the clasps of Heister; and strips of adhesive plasters; are all only inventions for the support of the parts, and keeping them from being disunited. When the suture failed, it was by these means, that the original deformity was corrected, together with that produced by the laceration, which would not have occurred without the suture. As then the dressings, when methodically applied, are capable of effectually rectifying the mischief of the suture, M. Louis inquires, why should they be considered only as a resource in a mere accidental case? Why should they not be made the chief and primary means of reuniting the lip, even when there is a loss of substance?

"Nothing can be opposed to the proofs adduced upon this point. They are even

from the practice of those, who have employed sutures without success. Such persons have themselves furnished the proofs of the bandage being capable of repairing the mischief resulting from the twisted suture."

M. Louis, with a view of perfecting our notions on this matter, lays it down as a fact, that the retraction of the muscles being the cause of the separation of the edges of the fissure, it is not to these edges we are to apply the force which is to unite them; but that it should be applied further to the very parts, whose action (the cause of the separation) is to be impeded, and whose contraction is thus to be prevented. A great many means for supporting the wound, only irritate the muscles and excite them to action, and it is this action which we should endeavour to overcome. The means for promoting union can only be methodical, when directly employed to prevent such action, by an immediate application on the point where it is to be resisted. The facility with which the parts may be brought forward, so as to bring the two commissures of the lips into contact, by the mere pressure of the hands, shows what may be expected from a very simple apparatus, which will execute the same office without any effort, in a firm and permanent manner, and which will render sutures unnecessary, the inconveniences of which are too well known.

M. Louis, after having explained the reasons of the theory, on which he founded his method, relates several cases, taken either from his own practice, or that of others, to illustrate its advantages. He details the history of twenty cases, in which his plan perfectly succeeded, both in accidental harelips, with considerable loss of substance, and in natural ones. In most of these instances, however, it was thought proper to assist the bandage with one stitch at the extremity of the fissure, close to the vermilion border of the lip, for the purpose of keeping the parts securely on a level.

Notwithstanding the operation, as performed with the twisted suture, is opposed by an authority of such weight as that of M. Louis, still it is the method most commonly practised. No modern surgeons doubt, that a harelip may be cured by means of adhesive plaster, and uniting bandages, quite as perfectly as with a suture; and all readily allow, that the first of these methods, as being more simple and less painful, would be preferable to the latter one, if it were equally sure of succeeding. But it is considered far more uncertain in its effect. To accomplish a complete cure, the parts to be united must be maintained in perfect contact, until they have contracted the necessary adhesion; and how can we always depend upon a bandage for keeping them from being displaced? What other means, besides a suture, affords in this respect such perfect security?

I shall first describe the operation, as usually done by surgeons of the present day

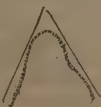
with the twisted suture. The first thing is to examine, whether there is any adhesion of the lip to the gum; and if there be, to divide it with a knife. Some authors (*Sharp*) recommend the frænnulum, which attaches the lip to the gum, always to be divided: but when the harelip is at some distance from this part, it will not be in the way of the operation, and need not be cut. On the other hand, when the frænnulum is situated in the centre of the division, it is clear, that in operating we must necessarily include it in the incision, and it should therefore be divided beforehand, taking care not to encroach too much upon the gum, lest the alveolar process be laid bare; nor too much upon the lip, because making it thinner would be unfavourable to its union.

When one of the incisor teeth, opposite the fissure, projects forward, it must be drawn, lest it distend and irritate the parts, after they have been brought into contact.

Sometimes, but particularly in cases in which there is a cleft in the bony part of the palate, a portion of the os maxillare superius forms such a projection, just in the situation of the fissure in the lip, that it would render the union very difficult, if not impracticable. In this circumstance, the common plan has been to cut off the projecting angles of bone with a strong pair of bone-nippers. The part was then healed, and the operation for the harelip performed. Instead of cutting off the projection of bone, which is always a painful measure, Desault used to employ simple compression, by which means the prominence was usually reduced in a few weeks, and the opportunity afforded of operating for the cure of the harelip. (*Œuvres Chir. par Bichat, T. 2, p. 207.*) Of course, the actual necessity for using bone-nippers, or even of having recourse to compression of the bony projection, will depend upon circumstances; for if the prominence of bone be sharp and irregular, no surgeon, I conceive, would hesitate about the removal of such inequalities, in preference to the trial of pressure. Mr. Dunn, of Scarborough, has expressed to me his doubts whether cutting off the projections of the alveolar process be ever necessary, as the pressure of the entire lip gradually diminishes the deformity. "I had (says he) two very unseemly cases, with an immense division of the palate, together with a projection of the alveolar process, which, with the incisor teeth, resembled the talons of a bird. A tubercular appendage of skin hung upon the base of the nose. By drawing the teeth, in the first place, very delicately, I avoided fracturing the bony projection. I then cut off one edge of the nasal appendage, and of the lip of the same side, and attached them together with two needles. The wound was sufficiently united in a week or ten days to allow the same operation on the other side. In less than three weeks, the boy was sent home quite well to the astonishment of the neighbourhood, where his frightful appearance made him an object of disgust and ridi-

cule. I succeeded in the other case, even without the extraction of the teeth. Both the patients can now articulate labial sounds, retain their saliva, and are gradually losing the inconvenience of the passage of the mucus from the nose into the mouth, as the fissure is more contracted, and the projection by no means so disagreeable." These facts should lessen the haste, with which certain operators proceed to cut off every projection of the alveolar process; for a moderate prominence of bone without any sharp, irritating edges, or angles, will not hinder the success of the operation; and even the propriety of removing teeth must entirely depend upon their being likely, by their direction, to irritate the lip, and disturb the union of the fissure.

In the operation, the grand object is to make as smooth and even a cut as possible, in order that it may more certainly unite by the first intention, and of such a shape, that the cicatrix may form only one narrow line. The edges of the fissure should, therefore, never be cut off with scissors, which constantly bruise the fibres which they divide, and a sharp knife is always to be preferred. The best plan is, either to place any flat instrument, such as a piece of horn, wood, or pasteboard, underneath one portion of the lip, and then holding the part stretched and supported on it, to cut away the whole of the callous edge: or else to hold the part with a pair of forceps, the under blade of which is much broader than the upper one: the first serves to support the lip; the other contributes also to this effect, and at the same time, serves as a sort of ruler in guiding the knife in an accurately straight line. When the forceps are preferred, the surgeon must of course leave on the side of the upper blade, just as much of the edge of the fissure as is to be removed, so that it can be cut off with one sweep of the knife. This is to be done on each side of the cleft, observing the rule, to make the new wound in straight lines, because the sides of it can never be made to correspond without this caution. For instance, if the harelip had this shape, the incision of the edges must be continued in straight lines, till they meet in the manner here represented. In short, the two incisions are to be perfectly straight, and are to meet at an angle above, in order that the whole track of the wound may be brought together, and united by the first intention.



Two silver pins, made with steel points, are next to be introduced through the edge of the wound, so as to keep them accurately in contact, the lowest pin being introduced first, near the inferior termination of the wound, and the upper pin afterward about a quarter of an inch higher up. A piece of thread is then to be repeatedly wound round the ends of the pins, from one side of the division to the other, first transversely, then obliquely, from the right or left end of one pin above, to the opposite end of the lower

one, &c. Thus the thread is made to cross as many points of the wound as possible, which greatly contributes to maintaining its edges in even apposition. Any portion of the wound above the pins, not closed by the preceding means, may now have its edges brought together with a strip of adhesive plaster. Lastly, the ends of the pins are to be supported by small dossils of lint, placed between them and the flesh; a minute, but essential circumstance, which, as my friend, Mr. Dunn, of Scarborough, reminds me, I forgot to mention in the last edition of this work. It is obvious, that a great deal of exactness is requisite in introducing the pins, in order that the edges of the incision may afterward be precisely applied to each other. For this purpose, some surgeons previously place the sides of the wound in the best position, and mark with a pen the points at which the pins should enter, and come out again; a method which, as far as my observations extend, merits imitation. The pins ought never to extend more deeply than about two-thirds through the substance of the lip, and it would be a great improvement always to have them of a flat, instead of a round shape, and a little curved, as this is the course which they naturally ought to take when introduced. The steel points should also admit of being easily taken off, when the pins have been applied, and, perhaps, having them to screw off and on is the best mode, as removing them in this way is not so likely to be attended with any sudden jerk, which might be injurious to the wound, as if they were made to pull off. In general, the pins may be safely removed in about four days, when the support of sticking plaster will be quite sufficient.

After the operation, the surgeon should never omit the use of compresses and a bandage for keeping forward the cheeks.

The process just described, is what is well known by the name of the *twisted suture*, which is applicable to other surgical cases, in which the grand object is to heal some fistula or opening, by the first intention. Mr. Sharp says, it is of great service in fistulæ of the urethra, remaining after the operation for the stone, in which case the callous edges may be cut off, and the lips of the wound held together by the above method.

What has hitherto been stated, refers to the most simple form of the harelip, viz. to that which presents only one fissure. When there are two clefts, the cure is accomplished on the same principle; but it is rather more difficult of execution; so that the old surgeons, until the time of Heister, almost all regarded the operation for the double harelip as impracticable, though they described it, with the direction to operate on each fissure, just as if it were single: M. de la Faye even operated in this way with success. (*Mémoires de l'Acad. de Chirurgie, Tom. 4. 4to.*) M. Louis was of opinion, that all difficulties would be obviated by doing the operation at two different times, and awaiting the perfect cure of one of the fissures, before that of the other was undertaken. Heis-

ter had similar ideas; but he never put the scheme in practice, nor did he even positively advise it.

After all, however, experience proves that it is not essential to perform two operations for the cure of the double harelip: Desault found, that when the edges of two fissures were pared off, and care taken to let one of the pins pass across the central piece of the lip, the practice answered extremely well. (See *Œuvres Chir. par Bichat, T. 2, p. 201.*)

In cutting off the edges of the fissure, the incision must be carried to the upper part of the lip; and even when the fissure does not reach wholly up the lip, the same thing should be done; for in this manner the sides of the wound will admit of being applied together more uniformly, and the cicatrix will have a better appearance. We should also not be too sparing of the edges which are to be cut off. Practitioners, says M. Louis, persuaded that the harelip was a division with loss of substance, have invariably advised the removal of the *callous* edges. But in the natural harelip there is no callosity; the margins of the fissure are composed, like those of the lip itself, of a pulpy, fresh-coloured, vermilion flesh, covered with an exceedingly delicate cuticle. The whole of the part having this appearance, must be taken away, together with a little of the true skin. At the lower part of the fissure, towards the nearest commissure, a rounded red substance is commonly situated, which it is absolutely necessary to include in the incision. Were this neglected, the union below would be unequal, and, through an injudicious economy, a degree of deformity would remain. The grand object, however, is to make the two incisions diverge at an acute angle, so that the edges may be put into reciprocal contact their whole length, without the least inequality.

M. Louis used to operate as follows: the patient being seated in a good light, his head is to be supported on an assistant's breast, who, with the fingers of both hands, pushes the cheeks forward, in order to bring the edges of the fissure near to each other. These are to be laid on a piece of pasteboard, which is to be put between the jaw and lip, and be an inch and a half long, from twelve to fifteen lines broad, and at most one line thick. The upper end should be rounded, by flattening the corners. In order to facilitate the incision, the lip is to be stretched over the pasteboard, the operator holding one portion over the right with the thumb and index finger of the left hand, while the assistant does the same thing on the left side. These being thus disposed, the edges of the harelip are to be cut off with two sweeps of the bistoury, in two oblique lines, forming an acute angle above the fissure.

For the removal of the edges of the harelip, scissors have sometimes been preferred to a knife, but, notwithstanding Desault's partiality to them, as most convenient, (See *Œuvres Chir. par Bichat, T. 2, p. 179.*) they are now very generally disused. The pinching and bruising which result from the action

of the blades, are circumstances which cannot be favourable to the union of the wound; and though they may not commonly be serious enough to prevent union by the first intention, they might occasionally tend, with any other untoward occurrence, to hinder this desirable event. Let not practitioners here be led by Mr. B. Bell's statement, that in one instance he cut off one side of the fissure with a knife, and the other with scissors; that the latter cut produced least pain, and that on this side there was no more swelling nor inflammation than on the opposite one.

The pins should be introduced at least two-thirds of the way through the substance of the lip, lest a furrow should remain on the inside of the part, which might prove troublesome, by allowing pieces of food to lodge in it. There is, however, a stronger reason for attending to this circumstance, viz. the hemorrhage which may take place when it is neglected. As soon as the edges of the wound have been brought together by means of the suture, and the pins are properly placed, the bleeding almost always ceases; but when the pins have not been introduced deeply enough, and the posterior surfaces of the incisions are not applied to each other, the blood may continue to run into the mouth, and give the surgeon an immense deal of trouble. In the memoir written by Louis, there is a case in which the patient died in consequence of such an accident. Persons who had undergone the operation, were always advised to swallow their spittle, even though mixed with blood, in order to avoid disturbing the wound, by getting rid of it otherwise. In the case alluded to, the patient, who had been operated upon for a cancerous affection of the lip, swallowed the blood as he had been directed to do, and he bled so profusely that he died. On the examination of the body, the stomach and small intestines were found full of blood. "This deplorable case," says the illustrious author who relates it, "deserves to be recorded for public instruction, for the purpose of keeping alive the attention of surgeons on all occasions, where, in consequence of any operation whatsoever, there is reason to apprehend bleeding in the cavity of the mouth. Platner is the only writer who, as far as I know, foresaw this kind of danger. The bleeding from the edges of the wound stops of itself, (says he,) as soon as they have been brought into contact, and stitched together; but care must be taken that the patient does not swallow the blood, which might make him vomit, or else suffocate him. Hence, his head should be elevated, that the blood may escape externally, a precaution more particularly necessary in young children."

Having described the mode of operating for the harelip, as approved of by the generality of practitioners, and detailed every thing which seemed material, I have now only to explain the method adopted by M. Louis. His sentiments respecting several particular points of the operation, have been already stated; and an account of the means

which he employed in lieu of the twisted suture, for uniting the edges of the wound, is all that remains to be noticed.

Several bandages for supporting the two portions of the divided lip, and lessening the pressure which they make against the pins, have been mentioned by authors. Franco and Quesnay, in particular, describe two kinds. These means were not only employed as auxiliary, but even sometimes as curative ones, when it was impossible to use needles. To such bandages, too complicated and too uncertain in their effect, M. Louis prefers a simple linen roller, one inch wide, three ells long, and rolled up into two unequal heads. He begins by applying the body of this bandage to the middle of the forehead; he unrolls the two heads, from before backward, above the ears, between the upper part of the cartilage and the cranium, in order to let them cross on the nape of the neck, and then pass forward again. The assistant, who supports the head, and pushes forward the cheeks, must lift up the ends of his fingers, in the place of which, on each side, a thick compress is to be put. This being covered, and pushed from behind forward, by the roller, will constantly perform the office of the assistant's fingers, who is to continue to support the apparatus until it is all completely applied. The longest of the two heads of the roller being slit in two places near the lip, presents two parallel openings; the remnant of the shortest one is divided into two parts, as far as its ends. The two little narrow bands in which it terminates, must then pass through the openings of the former, and cross upon the middle of the lip. The ends of the roller being carried from before backward, are then to be made to cross again on the nape of the neck, where the shortest is to end. The remainder of the long one is to be employed in making turns round the head. This bandage may be still more securely fixed by means of a piece of tape, which is to pass the forehead, over the sagittal suture, and be pinned at each end to the circumvolutions of the roller; while a second piece of tape is to cross the first one at the top of the head, and also to be attached, at its extremities, to the uniting bandage, and the compresses placed under the zygomatic arches, for the purpose of pushing forward the cheeks.

This bandage is extremely simple, and would promise great advantages if the twisted suture were unknown to practitioners. I think this last means will always be the favourite of the practical surgeon, because the desired effect can be produced by it with much less trouble than must be taken with the bandage, in order to render the operation of the latter sufficiently certain. Besides, as I have noticed, M. Louis himself mostly made one stitch near the red part of the lip, so that he cannot be said to have trusted altogether to the bandage.

However, as an auxiliary to the twisted suture, and a means of preventing the parts from being drawn to each side of the face so forcibly as to create a risk of the pins

cutting their way out by ulceration, a thick compress applied to each cheek, and pressed forward with a bandage, is still very usefully employed.

What has been said concerning the operation for the harelip, is equally applicable, not only to the treatment of cancer of the lip, but also to that of accidental cuts, or lacerations of this part, from any cause whatsoever. We shall only remark, that in a recent wound, all the surgeon has to do, is to apply the twisted suture and adhesive plaster without delay.

When there is a fissure in the bones forming the roof of the mouth, it usually diminishes, and gradually closes, after the harelip is cured. But this does not always happen, and when the parts remain so considerably separated, as to obstruct speech and deglutition, or cause any other inconvenience, a plate of gold or silver, exactly adapted to the arch of the palate, and steadied by means of a piece of sponge, fixed to its convex side, and introduced into the cleft, may sometimes be usefully employed. When the sponge is of suitable size, and very dry, before being used, the moisture of the adjacent parts will make it swell, and in many cases, be sufficient to keep it in its situation, so as greatly to facilitate speaking and swallowing. Sometimes, however, the fissure is so shaped, that the sponge cannot be fixed in it: this principally happens when the opening widens very much, towards the front of the jaw. In such cases, it has been proposed to fix a plate of gold, by means of springs, covered with the same metal. Platina, which is cheaper, might be used for the same purpose. The subject, however, of artificial palates is one, on which much mechanical ingenuity may yet be usefully exerted, and it can hardly be expected, that I should here do more, than give references to works, in which the reader may find information upon it. (See *Fauchard, Le Chirurgien Dentiste*, 2 Tom. 12mo. Paris, 1728; *Camper, Vermischte Schriften*, No. 13; *Loder's Journ.* 2 B. p. 25. p. 185, &c. *Von Sevelung über eine merkwürdige Kunstliche Ersetzung mehrerer, sowohl zur Sprache, als zum Schlucken nothwendiger zerstörter Werkzeuge*; 8vo. Heidelb. 1793; *Siebold, Chir. Tagebuch*, No. 20; *J. H. F. Autenrieth, Supplementa ad Hist. Embryonis Humani, quibus accedunt Observata quædam circa palatum fissum verosimillimamque illi medendi methodum*, 4to. Tubing. 1797; *Cullerion, in Journ. Gén. &c.* T. 19; *Récueil Period. &c.* T. 11, p. 22; *Dict. des Sciences Méd.* T. 37 art. *Obturateur*; *C. Graefe et Ph. von Walther, Journ. der Chir.* 1. B. p. 1. 8vo. Berlin, 1820; in this work, Graefe has described a method of curing fissures in the soft palate by means of a particular kind of suture, with the various instruments necessary in the operation. For information, relative to the harelip, see *B. Bell's Surgery*, Vol. 4. *Heister's Surgery*. *Le Dran's Operations*; *Sharp's Operations*; *F. D. Herissant, Mém. de l'Acad. des Sciences*, année 1743, p. 86; a very curious case,

complicated, with a fissure in the palate, and two oblong apertures at the sides of this cleft. In play, the child would sometimes fill his mouth with water, and through those apertures, let it spout out at the nostrils, in imitation of what takes place in whales. G. De la Faye, *Mém. de l'Acad. Royale de Chir.* T. 1, p. 605, année 1743. E. Sandfort, *Obs. Anat. Pathol.* 4to. et *Museum. Anat.* p. 110, 164. Ludg. Bat. 1777. *Plajani, Collezione d'Osservazioni*, &c. T. 3. 8vo. Roma. Latta's *Surgery*, vol. 2; *L'Encyclopédie Méthodique, Partie Chir. Art Bec de Lievre*. M. Louis, in *Mém. de l'Acad. de Chirurgie*, T. 4, p. 385. 4to. année 1768, T. 6, p. 292, année 1774; *De la Médecine Opératoire par Sabatier*, T. 3, p. 272. 8vo. Paris, 1810. *Œuvres Chir. de Desault*, par Bichat, T. 2, p. 173. *Traité des Opérations de Chirurgie*, par A. Bertrand, Chap. 19. P. N. Huguette, *Sur le Bec-de-lievre naturel*, 4to. Paris. 1804. J. Kirby, *Cases*, &c. 8vo. Lond. 1819; forceps recommended for holding the lip in the operation. Richter, *Anfangsgr. der Wundarzn.* B. 2, Kap. 7. Richerand, *Nosographie Chir.* T. 2, p. 265, &c. Edit. 4. Lassus *Pathologie Chir.* T. 3, p. 451, &c. Edit. 2. *Dict. des Sciences Méd.* T. 3, art. *Bec de Lievre*; Sprengel, *Geschichte der Chir. Operationen*, B. 1, p. 152. Graffe, *Angiectasia*, v. Langenbeck, *Bibl. 2 B.* p. 359. Eckoldt, *Ueber eine sehr complicirte Hasenscharte*; Leipzig. 1804. fol.)

* **HEAD, INJURIES OF.** Mr. Pott remarks, that though the scalp be called the common tegument of the head, yet from the variety of parts of which it is composed, from their structure, connexions, and uses, injuries done to it by external violence, become of much more consequence, than the same kind of ill can prove, when inflicted on the common teguments of the rest of the body.

Passing over incised wounds, which have no particularity, Mr. Pott proceeds immediately to lacerated and punctured wounds. "The former may be reduced to two kinds, viz. those in which the scalp, though torn, or unequally divided, still keeps its natural situation, and is not stript nor separated from the cranium, to any considerable distance beyond the breadth of the wound; and those in which it is considerably detached from the parts it ought to cover. The first of these, if simple, and not combined with the symptoms, or appearances of any other mischief, do not require any particular or different treatment, from what the same kind of wounds require on all other parts;" but with respect to those in which the scalp is separated and detached from the parts it ought to cover, Mr. Pott makes no scruple of declaring it as his opinion, that its preservation ought always to be attempted, unless it be so torn as to be absolutely spoiled, or there are manifest present symptoms of other mischief. In former days, the excision of the lacerated and detached scalp was the general practice; but Mr. Pott had so often made the experiment of endeavouring to preserve the torn piece, and so often succeeded, that he recommended it as a thing

always to be attempted, even though a part of the cranium were perfectly bare.

Here I may remark, that all practitioners now invariably avoid cutting away the scalp, even in the circumstances in which such practice was allowed by Pott. By spoiled, this eminent writer must mean so injured as necessarily to slough afterward. However, as no harm results from taking the chance of its not sloughing, which never can be with certainty foretold; and as the excision of the part is painful, and productive of no benefit, even if sloughing must follow, such operation is, in every point of view, hurtful and wrong. With respect to other mischief, as a reason, the examination of the cranium, and even the application of the trephine, never require any of the scalp to be cut away. See *Trephine*.

Let the surgeon, therefore, free the torn piece from all dirt, or foreign bodies, and restore it as quickly, and as perfectly as he can, to its natural situation.

Notwithstanding Mr. Pott assents to the employment of sutures, for uniting certain lacerated wounds of the scalp, the best practitioners of the present day generally employ only sticking-plaster. Sometimes, the loosehed scalp will unite with the parts from which it is torn and separated, and there will be no other sore, than what arises from the impracticability of bringing the lips of the wound into smooth and immediate contact, the scar of which sore must be small in proportion. Sometimes such perfect reunion is not to be obtained; in which case, matter will be formed and collected in those places where the parts do not coalesce: but this does not necessarily make any difference, either in the general intention, or in the event; this matter may easily be discharged, by one or two small openings made with a lancet; the head will still preserve its natural covering; and the cure will be very little retarded by a few small abscesses.

In some cases (as Pott proceeds to describe,) the whole separated piece will unite perfectly, and give little or no trouble, especially in young and healthy persons. In some, the union will take place in some parts and not in others; and consequently, matter will be formed, and require to be discharged, perhaps at several different points; and in some particular cases, circumstances, and habits, there will be no union at all, the torn cellular membrane, or the naked aponeurosis, will inflame and become sloughy, a considerable quantity of matter will be collected, and perhaps the cranium will be denuded. But even in this state of things, which does not very often happen, where care has been taken, and is almost the worst which can happen, in the case of mere simple laceration and detachment, if the surgeon will not be too soon, nor too much alarmed, nor in a hurry to cut, he will often find the cure much more feasible than he may at first imagine: let him take care to keep the inflammation under by proper means, let him have patience till

the matter is fairly and fully formed, and the sloughs perfectly separated, and when this is accomplished, let him make a proper number of dependent openings for the discharge of them, and let him by bandage, and other proper management, keep the parts in constant contact with each other, and he will often find, that although he was foiled in his first intention of procuring immediate union, yet he will frequently succeed in this his second; he will still save the scalp, shorten the cure, and prevent the great deformity arising (particularly to women) not only from the scar, but from the total loss of hair.

This union may often be procured, even though the cranium should have been perfectly denuded by the accident; and it is true, not only though it should have been stripped of its pericranium at first, (See *Abernethy on the Injuries of the Head, Case 6.*) but even if that pericranium should have become sloughy and cast off, as Mr. Pott has often seen.

“Exfoliation from a cranium laid bare by external violence, and to which no other injury has been done, than merely stripping it of its covering, is a circumstance (says Pott) which would not so often happen, if it was not taken for granted that it must be, and the bone treated according to such expectation. The soft open texture of the bones of children and young people, will frequently furnish an incarnation, which will cover their surface, and render exfoliation quite unnecessary; and even in those of mature age, and in whom the bones are still harder, exfoliation is full as often the effect of art as the intention of nature, and produced by a method of dressing, calculated to accomplish such end, under a supposition of its being necessary. Sometimes, indeed, it happens that a small scale will necessarily separate, and the sore cannot be perfectly healed till such separation has been made; but this kind of exfoliation will be very small and thin, in proportion to that produced by art, that is, that produced by dressing the surface of the bare bone with spirituous tinctures, &c.

“Small wounds, that is, such as are made by instruments, or bodies which pierce, or puncture, rather than cut, are in general more apt to become inflamed, and to give trouble, than those which are larger, and in this part particularly, are sometimes attended with so high inflammation, and with such symptoms as alarm both patient and surgeon.

“If the wound affects the cellular membrane only, and has not reached the aponeurosis or pericranium, the inflammation and tumour affect the whole head and face, the skin of which wears a yellowish cast, and is sometimes thick set with small blisters, containing the same coloured serum; it receives the impression of the fingers, and becomes pale for a moment, but returns immediately to its inflamed colour; it is not very painful to the touch, and the eyelids and ears are always comprehended in the tumefaction, the

former of which are sometimes so distended as to be closed; a feverish heat and thirst generally accompany it; the patient is restless, has a quick pulse, and most commonly a nausea, and inclination to vomit.

“This accident generally happens to persons of bilious habit, and is indeed an inflammation of the erysipelatous kind; it is somewhat alarming to look at, but is not often attended with danger. The wound does indeed neither look well, nor yield a kindly discharge, while the fever continues, but still it has nothing threatening in its appearance, none of that look which bespeaks internal mischief; the scalp continues to adhere firmly to the skull, and the patient does not complain of that tense pain, nor is he afflicted with that fatiguing restlessness which generally attends mischief underneath the cranium.

“Phlebotomy, lenient purges, and the use of the common febrifuge medicines, particularly those of the neutral kind, generally remove it in a short time. When the inflammation is gone off, it leaves on the skin a yellowish tint, and a dry scurf, which continue until perspiration carries them away, and upon the disappearance of the disease, the wound immediately recovers a healthy aspect, and soon heals without any farther trouble.

“Wounds and contusions of the head, which affect the brain and its membranes, are also subject to an erysipelatous kind of swelling and inflammation: but it is very different, both in its character and consequences from the preceding.

“In this, (which is one of the effects of inflammation of the meninges,) the febrile symptoms are much higher, the pulse harder and more frequent, the anxiety and restlessness extremely fatiguing, the pain in the head intense; and as this kind of appearance is, in these circumstances, most frequently the immediate precursor of matter forming between the skull and dura mater, it is generally attended with irregular shiverings, which are not followed by a critical sweat, nor afford any relief to the patient. To which it may be added, that in the former case, the erysipelas generally appears within the first three or four days; whereas in the latter, it seldom comes on till several days after the accident, when the symptomatic fever is got to some height. In the simple erysipelas, although the wound be crude and undigested, yet it has no other mark of mischief; the pericranium adheres firmly to the skull, and upon the cessation of the fever, all appearances become immediately favourable. In that which accompanies injury done to the parts underneath, the wound not only has a spongy, glassy, unhealthy aspect, but the pericranium in its neighbourhood separates spontaneously from the bone, and quits all cohesion with it. In short, one is an accident, proceeding from a bilious habit, and not indicating any mischief beyond itself; the other is a symptom, or a part of a disease, which is occasioned by injury done to the membranes of the brain; one portends little

or no ill to the patient, and almost always ends well; the other implies great hazard, and most commonly ends fatally. It is therefore hardly necessary to say, that it behooves every practitioner to be careful in distinguishing them from each other.

"If the wound be a small one, and has passed through the cellular membrane to the aponeurosis, and pericranium, it is sometimes attended with very disagreeable, and even very alarming symptoms, but which arise from a different cause, and are very distinguishable from what has been yet mentioned.

"In this, the inflamed scalp does not rise into that degree of tumefaction, as in the erysipelas, neither does it pit, or retain the impression of the fingers of an examiner, it is of a deep red colour, unmixt with the yellow tint of the erysipelas; it appears tense, and is extremely painful to the touch; as it is not an affection of the cellular membrane, and as the ears and the eyelids are not covered by the parts in which the wound is inflicted, they are seldom, if ever, comprehended in the tumour, though they may partake of the general inflammation of the skin; it is generally attended with acute pain in the head, and such a degree of fever as prevents sleep, and sometimes brings on a delirium.

"A patient, in these circumstances, will admit more free evacuations by phlebotomy, than one labouring under an erysipelas; the use of warm fomentation is required in both, in order to keep the skin clean and perspirable, but an emollient cataplasm, which is generally forbid in the former, may in this latter case be used to great advantage.

"When the symptoms are not very pressing, nor the habit very inflammable, this method will prove sufficient; but it sometimes happens, that the scalp is so tense, the pain so great, and the symptomatic fever so high, that by waiting for the slow effect of such means, the patient runs a risk from the continuance of the fever, or else the injured aponeurosis and pericranium becoming sloughy, produce an abscess, and render the case both tedious and troublesome." A division of the wounded part by a simple incision down to the bone, about half an inch or an inch in length, will most commonly remove all the bad symptoms, and if it be done in time, will render every thing else unnecessary." (*Pott.*) With respect to the good effects of such an incision, Desault considers them greatly exaggerated by authors; and while he admits, that they are useful, when the inflammation extends under the aponeurosis, he is not inclined to sanction it as a right proceeding in every other instance. (See *Œuvres Chir. par Bichat*, T. 2, p. 8.)

Thus, Mr. Pott was of opinion, that the differences of the symptoms in the foregoing cases depended upon, whether the wound only affected the skin and cellular membrane, or reached more deeply to the aponeurosis and pericranium; a doctrine which has been justly regarded as questionable. With respect to the observation, that in a puncture of the aponeurosis, the swelling is confined within the limits of this fascia, and

does not extend to the ears and eyelids, it is a sentiment which Desault thought arose rather from anatomical considerations, than the observation of nature. The doctrine indeed, must appear doubtful, when it is recollected: 1st, That the aponeurosis and pericranium are parts of scarcely any sensibility. 2dly, That the opinion had its origin at a period when these parts were imagined to be highly sensible. 3dly, That in other parts of the body, a wound in which a fascia, or the periosteum is concerned, is rarely attended with the above described severe symptoms. 4thly, That here the wounds often affect only the skin and cellular membrane, and yet these symptoms occur, even with a phlegmonous character. 5thly, On the contrary, in other instances in which the aponeurosis and pericranium are undoubtedly wounded, no bad symptoms at all take place. 6thly, These symptoms may almost always be removed by the exhibition of tartarized antimony. (*Œuvres Chir. de Desault*, T. 2, p. 8.)

In the case, often named inflammation of the fascia after bleeding, it is not the fascia itself, which is the real and chief seat of the pain, inflammation, &c. but the subjacent cellular membrane and muscles. The theory of Desault is, that the erysipelatous affections of the scalp, so frequent after injuries of the head, are connected with disorder of the functions of the liver, produced by such accidents. Yet it is difficult to understand, why a mere puncture of the scalp should cause this disorder of the liver, more commonly than the same kind of wound of any other superficial part of the body.

The injuries to which the scalp is liable from contusion, or appearances produced in it by such general cause, may be divided into those, in which the mischief is confined merely to the scalp; and those in which other parts are interested.

The former, which only come under our present consideration, are not indeed of importance, considered abstractedly. The tumour is either very readily dissipated, or the extravasated blood causing it, is easily got rid of by a small opening. J. L. Petit first, and afterward Pott, particularly noticed this case, on account of an accidental circumstance, which sometimes attends it, and renders it liable to be very much mistaken.

"When the scalp receives a very smart blow, it often happens that a quantity of extravasated blood immediately forms a tumour, easily distinguishable from all others, and generally very easily cured. But it also sometimes happens, that this kind of tumour produces to the fingers of an unadvised or inattentive examiner, a sensation, so like to that of a fracture, with depression of the cranium, as may be easily mistaken." Now, if upon such supposition, a surgeon immediately makes an incision into the tumid scalp, he may give his patient a great deal of unnecessary pain, and for that reason run some risk of his own character.

"The touch is, in this case, so liable to deception, that recourse should always be

had to other circumstances and symptoms, before an opinion be given.

"If a person, with such tumour occasioned by a blow, and attended with such appearances and feel, has any complaint, which seems to be the effect of pressure made on the brain and nerves, or of any mischief done to the parts within the cranium, the division or removal of the scalp, in order to inquire into the state of the skull, is right and necessary; but if there are no such general symptoms, and the patient is in every respect perfectly well, the mere feel of something like a fracture will not authorize or vindicate such operation, since it will often be found, that such sensation is a deception, and that when the extravasated fluid is removed, or dissipated, the cranium is perfectly sound and uninjured."—(Pott.)

With the exception of instances, in which the dura mater suppurates from a blow on the head, and the symptoms are such as to require the trephine, or other examples, in which an abscess forms under the scalp, or a large quantity of blood is effused in the same situation, none of the cases which have here been considered, can justify making incisions in the scalp: and the utility of the practice in what was supposed by Pott to be an inflammation of the aponeurosis, is at least questionable, as far as it is done under the idea of merely obviating tension, without there being any matter to be discharged. Incisions expressly for the purpose of exposing the bone are only right, as a preparatory step to trephining, when the necessity for this operation is indicated by decided and urgent symptoms of pressure on the brain. Now, such pressure, in any of the examples above treated of, can only arise from suppuration under the skull, a subject, which I shall leave, as having been already fully discussed.

Dr. Hennen, in his truly practical work, has very properly advised surgeons not to be content with clipping away a little of the hair around the injury, but always to have the head shaved to a proper extent. This proceeding, which is perfectly harmless in itself, is more generally right, than the custom of cutting the scalp, which has been too frequently employed without any rational aim. The free removal of the hair directly after the accident, often brings into view marks indicative of other parts of the head having been struck, besides that which is at first noticed, and thus the practitioner will have a more correct notion of the serious nature of the accident, than he might otherwise have conceived, and be more strict in his mode of treatment. Nay, fractures and depression of the skull, sometimes not denoted by any disturbance of the functions of the brain, and liable to escape observation, while concealed under the hair, are frequently detected after its removal, and the surgeon, being now aware of the extent and situation of the mischief, must of course be better qualified to conduct the treatment. In short, as Dr. Hennen has observed; "Independent of the more accurate view, (thus procured,) we facilitate the application of leeches, if they

may be found necessary, and of a most excellent adjuvant on all occasions, viz. cold applications."

It affords me particular pleasure to be able to number so good a surgeon as Dr. Hennen, among the advocates of Schmucker's plan of having the head well shaved and covered with cloths, wet with a very cold lotion; a practice which the latter eminent surgeon always adopted, whether a sabre cut, or gunshot injury of this part, had the appearance of being serious, or not. "As soon as the patient was brought to the hospital with a wound of the head, whether the injury looked important or not, (says Schmucker) I directed the hair to be immediately removed, and after the necessary dilatation, applied dressings. Sixteen ounces of blood were next taken away, and the evacuation, in less quantity, repeated according to circumstances, three or four times, within the space of twenty-four hours. The pulse now generally became softer, and the determination of blood to the head lessened. Over the dressings, and the whole of the head, thick cloths, dipped in the cold mixture, hereafter specified, were laid, and renewed every hour. These cloths were kept in their place with the bandage called the grand couvre-chef. (See *Bandage*.) As internal medicines, the nitrate of potassa, neutral salts, and emollient and stimulating clysters, and gentle aperients, were given. These means were employed, both in slight injuries, and in those where the bones were depressed, and fissures and fractures were accompanied with violent convulsive twitchings, coma, paralysis, and other bad symptoms; and even in cases where the use of the trephine was indispensable, the practice was continued until the cure was complete." Schmucker assures us, that under such treatment, fewer patients with wounds of the head were lost, than used previously to happen, especially of those whose injuries at first had the appearance of being but slight. (See *Chir. Wahrnehmungen*, 1 B. p. 154.)

Schmucker was led to try this practice by the great benefit which he had seen afforded by the application of cold water to the head in cases of mania, attended with great determination of blood to the brain. And, in order to increase the efficacy of the water, he added to every five gallons of it two quarts of vinegar, sixteen ounces of nitre, and eight of the muriate of ammonia. This mixture was then preserved for use in a cold place. (*Vol. cit. p. 153.*) Or in order to avail ourselves of the full frigorific effects of this mixture, it should be prepared, as Dr. Hennen observes, in small quantities, and used immediately before its temperature has risen; or, "snow or pounded ice, or ice-water, applied to the parts in a half filled bladder, or cloths simply dipped in cold water, will often answer every purpose." (*On Military Surgery*, p. 279, Edit. 2.) Dr. Hennen mentions one important fact, in recommendation of cold applications, antimonials, and saline purgatives, preceded by the common blue pill, and assisted with quiet,

and abstinence; viz. by such means; "those troublesome puffy enlargements and erysipelatous affections of the scalp, which so often succeed to bruises," are prevented; and, where the evacuant plan is duly observed, the "extensive and formidable erysipelatous affections, so common formerly, are rare and mild at present in military hospitals."

2. Effects of Contusion on the Dura Mater and Parts within the Skull.

It is observed by Mr. Pott, that by blows, falls, and other shocks, some of the larger of those vessels which carry on the communication between the dura mater and the skull are broken, and a quantity of blood is shed upon the surface of that membrane. This is one species of bloody extravasation, and indeed the only one which can be formed between the skull and dura mater. If the broken vessels be few, and the quantity of blood which is shed be small, the symptoms are generally slight, and by proper treatment disappear. If they are large, or numerous, or the quantity of extravasated fluid considerable, the symptoms are generally urgent in proportion; but whether they be slight, or considerable, whether immediately alarming or not, they are always and uniformly such as indicate pressure made on the brain and nerves, viz. stupidity, drowsiness, diminution or loss of sense, speech, and voluntary motion.

According to Mr. Pott, it also often happens, from the same kind of violence, that some of the small vessels, which carry on the circulation between the pericranium, skull, and dura mater, are so damaged, as not to be able properly to execute that office, although there are none so broken as to cause an actual effusion of blood.

"Smart and severe strokes on the middle part of the bones, at a distance from the sutures, are most frequently followed by this kind of mischief; the coats of the small vessels, which sustain the injury, inflame and become sloughy, and in consequence of such alteration in them, the pericranium separates from the outside of that part of the bone, which received the blow, and the dura mater from the inside, the latter of which membranes, soon after such inflammation, becomes sloughy also, and furnishes matter, which matter being collected between the said membrane and the cranium, and having no natural outlet, whereby to escape, or be discharged, brings on a train of very terrible symptoms, and is a very frequent cause of destruction. The effect of this kind of violence is frequently confined to the vessels connecting the dura mater to the cranium, in which case, the matter is external to the said membrane; but it sometimes happens, that by the force either of the stroke or of the concussion, the vessels which pass between, and connect the two meninges, are injured in the same manner; in which case, the matter formed in consequence of such violence is found on the surface of the brain, or between the pia and

dura mater, as well as on the surface of the latter; or, perhaps, in all these three situations at the same time.

"The difference of this kind of disease, from either an extravasation of blood, or a commotion of the medullary parts of the brain, is great and obvious. All the complaints produced by extravasation, are such as proceed from pressure made on the brain and nerves, and obstruction to the circulation of the blood through the former; stupidity, loss of sense and voluntary motion, laborious and obstructed pulse and respiration, &c. and (which is of importance to remark,) *if the effusion be at all considerable, these symptoms appear immediately, or very soon after the accident.*

"The symptoms attending an inflamed or sloughy state of the membranes, in consequence of external violence, are very different; they are all of the febrile kind, and never, at first, imply any unnatural pressure; such are, pain in the head, restlessness, want of sleep, frequent and hard pulse, hot and dry skin, flushed countenance, inflamed eyes; nausea, vomiting, rigour; and toward the end, convulsion and delirium. And *none of these appear at first, that is, immediately after the accident; seldom until some days are passed.*

"One set or class of symptoms is produced by an extravasated fluid, making such pressure on the brain and origin of the nerves, so as to impair or abolish voluntary motion and the senses; the other is caused by the inflamed or putrid state of the membranes covering the brain, and seldom affects the organs of sense, until the latter end of the disease, that is, until a considerable quantity of matter is formed, which matter must press like any other fluid.

"If there be neither fissure nor fracture of the skull nor extravasation, nor commotion underneath it, and the scalp be neither considerably bruised, nor wounded, the mischief is seldom discovered or attended to for some few days. The first attack is generally by pain in the part which received the blow. This pain, though beginning in that point, is soon extended all over the head, and is attended with a languor, or dejection of strength and spirits, which are soon followed by a nausea, and inclination to vomit, a vertigo or giddiness, a quick and hard pulse, and an incapacity of sleeping, at least quietly. A day or two after this attack, if no means preventive of inflammation are used, the part stricken generally swells, and becomes puffy and tender; but not painful; neither does the tumour rise to any considerable height, or spread to any great extent: if this tumid part of the scalp be now divided, the pericranium will be found of a darkish hue, and either quite detached, or very easily separable from the skull, between which will be found a small quantity of a dark-coloured ichor.

"If the disorder has made such progress, that the pericranium is quite separated and detached from the skull, the latter will even now be found to be somewhat altered in co-

lour from a sound healthy bone. Of this alteration it is not very easy to convey an idea by words, but it is a very visible one, and what some very able writers have noticed.

"From this time the symptoms generally advance more hastily and more apparently; the fever increases, the skin becomes hotter, the pulse quicker and harder, the sleep more disturbed, the anxiety and restlessness more fatiguing; and to these are generally added irregular rigours, which are not followed by any critical sweat, and which, instead of relieving the patient, add considerably to his sufferings. If the scalp has not been divided or removed, until the symptoms are thus far advanced, the alteration of the colour of the bone will be found to be more remarkable; it will be found to be whiter and more dry than a healthy one; or, as Fallopius has very justly observed, it will be found to be more like a dead bone: the sanies, or fluid, between it and the pericranium, will also, in this state, be found to be more in quantity, and the said membrane will have a more livid diseased aspect.

"In this state of matters, if the dura mater be denuded, it will be found to be detached from the inside of the cranium, to have lost its bright silver hue, and to be, as it were, smeared over with a kind of mucus, or with matter, but not with blood. Every hour after this period, all the symptoms are exasperated, and advance with hasty strides: the headach and thirst become more intense, the strength decreases, the rigours are more frequent, and at last convulsive motions, attended in some with delirium, in others with paralysis, or comatose stupidity, finish the tragedy.

"If the scalp has not been divided till this point of time, and it be done now, a very offensive discoloured kind of fluid will be found lying on the bare cranium, whose appearance will be still more unlike to the healthy natural one; if the bone be now perforated, matter will be found between it and the dura mater, generally in considerable quantity, but different in different cases and circumstances. Sometimes it will be in great abundance, and diffused over a large part of the membrane; and sometimes the quantity will be less, and consequently the space which it occupies smaller. Sometimes it lies only on the exterior surface of the dura mater; and sometimes it is between it and the pia mater, or also even on the surface of the brain, or within the substance of it, &c.

"As the inflammation and separation of the dura mater is not an *immediate* consequence of the violence, so neither are the symptoms immediate, seldom until some days have passed; the fever at first is slight, but increases gradually; as the membrane becomes more and more diseased, all the febrile symptoms are heightened; the formation of matter occasions rigours, frequent and irregular, until such a quantity is collected, as brings on delirium, spasm, and death."

Hitherto Mr. Pott has been describing this disease as unaccompanied with any other, not even with any external mark of injury,

except perhaps a trifling bruise of the scalp; "Let us now, (says this eminent surgeon) suppose the scalp to be wounded at the time of the accident, by whatever gave the contusion; or let us suppose, that the immediate symptoms having been alarming, a wound had been made, in order to examine the skull.

"In this case, the wound will for some little time have the same appearance as a mere simple wound of this part, unattended with other mischief, would have; it will, like that, at first discharge a thin sanies, or gleet, and then begin to suppurate; it will digest, begin to incarnate, and look perfectly well; but, after a few days, all these favourable appearances will vanish; the sore will lose its florid complexion, and granulated surface; will become pale, glassy, and flabby; instead of good matter, it will discharge only a thin discoloured sanies; the lint with which it is dressed, instead of coming off easily (as in a kindly suppurating sore) will stick to all parts of it; and the pericranium instead of adhering firmly to the bone, will separate from it, all round, to some distance from the edges.

"This alteration in the face and circumstances of the sore, is produced merely by the diseased state of the parts underneath the skull; which is a circumstance of great importance, in support of the doctrine advanced; and is demonstrably proved, by observing that this diseased aspect of the sore, and this spontaneous separation of the pericranium, are always confined to that part which covers the altered or injured portion of the dura mater, and do not at all affect the rest of the scalp; nay, if it has by accident been wounded in any other part, or a portion has been removed from any part where no injury has been done to the dura mater, no such separation will happen, the detachment above will always correspond to that below, and be found nowhere else.

"The first appearance of alteration in the wound immediately succeeds the febrile attack; and as the febrile symptoms increase, the sore becomes worse and worse, that is, degenerates more and more from a healthy, kindly aspect.

"Through the whole time, from the first attack of the fever, to the last and fatal period, an attentive observer will remark the gradual alteration of the colour of the bone, if it be bare. At first it will be found to be whiter, and more dry, than the natural one; and as the symptoms increase, and either matter is collected, or the dura mater becomes sloughy, the bone inclines more and more to a kind of purulent hue, or whitish yellow; and it may also be worth while in this place to remark, that if the blow was on or very near to a suture, and the subject young, the said suture will often separate in such a manner as to let through it a loose, painful, ill-natured fungus; at which time also, it is no uncommon thing for the patient's head and face to be attacked with an erysipelas.

"In those cases, in which the scalp is very

little injured by the bruise, and in which there is no wound, nor any immediate alarming symptoms or appearances, the patient feels little or no inconvenience, and seldom makes any complaint, until some few days are past. At the end of this uncertain time, he is generally attacked by the symptoms already recited; these are not pressing at first, but they soon increase to such a degree, as to baffle all our art: from whence it will appear, that when this is the case, the patient frequently suffers from what seems at first to indicate his safety, and prevents such attempts being made, and such care from being taken of them, as might prove preventive of mischief.

"But if the integuments are so injured as to excite or claim our early regard, very useful information may from thence be collected; for whether the scalp be considerably bruised, or whether it be found necessary to divide it for the discharge of extravasated blood, or on account of worse appearances, or more urgent symptoms, the state of the pericranium may be thereby sooner and more certainly known: if in the place of such bruise, the pericranium be found spontaneously detached from the skull, having a quantity of discoloured sanies between them under the tumid part, in the manner already mentioned, it may be regarded as a pretty certain indication, either that the dura mater is beginning to separate in the same manner, or that if some preventive means be not immediately used, it will soon suffer; that is, it will inflame, separate from the skull, and give room for a collection of matter between them. And with regard to the wound itself, whether it was made at the time of the accident, or afterward artificially, it is the same thing; if the alteration of its appearance be as related, if the edges of it spontaneously quit their adhesion to the bone, and the febrile symptoms are at the same time making their attack, these circumstances will serve to convey the same information, and to prove the same thing.

"The particular effect of contusion is frequently found to attend on fissures, and undepressed fractures of the cranium, as well as on extravasations of fluid, in cases where the bone is entire; and on the other hand, all these do often happen without the concurrence of this individual mischief. All this is matter of accident; but let the other circumstances be what they may, the spontaneous separation of the altered pericranium, in consequence of a severe blow, is almost always followed by suppuration between the cranium and dura mater; a circumstance extremely well worth attending to in fissures and undepressed fractures of the skull, because it is from this circumstance principally, that the bad symptoms, and the hazard, in such cases arise.

"It is no very uncommon thing for a smart blow on the head to produce some immediate bad symptoms, which after a short space of time disappear, and leave the patient perfectly well. A slight pain in the

head, a little acceleration of pulse, a vertigo and sickness, sometimes immediately follow such accident, but do not continue many hours, especially if any evacuation has been used. These are not improbably owing to a slight commotion of the brain, which having suffered no material injury thereby, soon cease. But if, after an interval of some time, the same symptoms are renewed; if the patient, having been well, becomes again feverish, and restless, and that without any new cause; if he complains of being languid and uneasy, sleeps disturbedly, loses his appetite, has a hot skin, a hard quick pulse, and a flushed, heated countenance; and neither irregularity of diet, nor accidental cold, have been productive of these; mischief is most certainly impending, and that most probably under the skull.

"If the symptoms of pressure, such as stupidity, loss of sense, voluntary motion, &c. appear some few days after the head has suffered injury from external mischief, they do most probably imply an effusion of a fluid somewhere: this effusion may be in the substance of the brain, in its ventricles, between its membranes, or on the surface of the dura mater; and which of these is the real situation of such extravasation, is a matter of great uncertainty, none of them being attended with any peculiar mark or sign that can be depended upon, as pointing it out precisely; but the inflammation of the dura mater, and the formation of matter between it and the skull, in consequence of contusion, is generally indicated and preceded by one which Mr. Pott has hardly ever known to fail; a *puffy, circumscribed, indolent tumour of the scalp, and a spontaneous separation of the pericranium from the skull under such tumour.*

"These appearances, therefore, following a smart blow on the head, and attended with languor, pain, restlessness, watching, quick pulse, headach, and slight irregular shiverings, do almost infallibly indicate an inflamed dura mater, and pus, either forming or formed between it and the cranium."

By detachment of the pericranium, is not meant every separation of it from the bone which it should cover. It may be, and often is, cut, torn, or scraped off, without any such consequence; but these separations are violent, whereas that which Mr. Pott means is spontaneous, and is produced by the destruction of those vessels by which it was connected with the skull, and by which the communication between it and the internal parts was carried on; and therefore it is to be observed, that it is not the mere removal of that membrane which causes the bad symptoms, but it is the inflammation of the dura mater; of which inflammation, this spontaneous secession of the pericranium is an almost certain indication.

Sometimes the scalp is so wounded at the time of the accident or so torn away, as to leave the bone perfectly bare; and yet the violence has not been such as to produce the evil just now spoken of. In this case, if the pericranium be only turned back, along with

the detached portion of scalp, there may be probability of its reunion; and it should therefore be immediately made clean and replaced for the purpose of such experiment; which, if it succeeds, will save time, and prevent considerable deformity. Should the attempt fail, it can only be in consequence of the detached part sloughing. Hence, removing it with a knife, though allowed by Pott, is now never practised. Frequently when the scalp does not adhere at once, it becomes attached to the cranium afterwards by a granulating process. When the detached piece sloughs, the worst that can happen, is an exfoliation from the bare skull.

Sometimes the force which detaches or removes the scalp, also occasions the mischief in question; but the integuments being wounded or removed, we cannot have the criterion of the tumour of the scalp for the direction of our judgment. Our whole attention must be directed to the wound and general symptoms. The edges of the former will digest as well, and look as kindly for a few days, as if no mischief was done underneath. But after some little space of time, when the patient begins to be restless and hot, and to complain of pain in the head, these edges will lose their vermilion hue, and become pale and flabby. Instead of matter, they will discharge a thin gleet, and the pericranium will loosen from the skull, to some distance from the said edges. Immediately after this, all the general symptoms are increased and exasperated; and as the inflammation of the membrane is heightened or extended, they become daily worse and worse, until a quantity of matter is formed and collected, and brings on that fatal period, which, though uncertain as to date, very seldom fails to arrive.

"The method of attempting the relief of this kind of injury consists in two points, viz. to endeavour to prevent the inflammation of the *dura mater*; or, that being neglected, or found impracticable, to give discharge to the fluid collected within the cranium in consequence of such inflammation.

"Of all the remedies in the power of art for inflammations of membranous parts, there is none equal to phlebotomy. To this truth many diseases bear testimony; pleurisies, ophthalmies, strangulated hernias, &c. and if any thing can particularly contribute to the prevention of the ills likely to follow severe contusions of the head, it is this kind of evacuation; but then it must be made use of in such a manner as to become truly a preventive; that is, it must be made use of immediately and freely."

Mr. Pott admits that it will in general be found very difficult to persuade a person, who has had what may be called only a knock on the pate, to submit to such discipline, especially if he finds himself tolerably well: yet in many instances, the timely use, or the neglect of this single remedy, makes all the difference between safety and fatality.

"It may be said that as the force of the blow, the height of the fall, the weight of the instrument, &c. can never precisely, or

certainly determine the effect, nor inform us whether mischief is done under the bone or not, a large quantity of blood may be drawn off unnecessarily, in order to prevent an imaginary evil. This is in some degree true; and if the advice just given was universally followed, many people would be largely bled without necessity; but then, on the other hand, many a very valuable life would be preserved, which, for want of this kind of assistance, is lost. *Nihil interest, præsidium an salis tutum sit, quod unicuique*, is an incontestable maxim in medicine; and if it be allowed to use such means as may be in themselves hazardous, surely it cannot be wrong to employ one which is not so; at least, if it be considered in a general sense, whatever it may accidentally prove to some few particular individuals."

Acceleration or hardness of pulse, restlessness, anxiety, and any degree of fever, after a smart blow on the head, are always to be suspected and attended to. Immediate, plentiful, and repeated evacuations by bleeding, have, in many instances, removed these, in persons, to whom, Mr. Pott firmly believes, very terrible mischief would have happened, had not such precaution been used. In this, as well as some other parts of practice, we neither have, nor can have any other method of judging, than by comparing together cases apparently similar. Mr. Pott has more than once or twice seen that increased velocity and hardness of pulse, and that oppressive languor, which most frequently precede mischief under the bone, removed by free and repeated bloodletting; and has often, much too often, seen cases end fatally, whose beginnings were full as slight, but in which such evacuation had been either neglected, or not complied with. This judicious writer "would by no means be thought to infer from hence, that early bleeding will always prove a certain preservative; and that they only die, to whom it has not been applied: this, like all other human means, is fallible; and, perhaps, there are more cases out of its reach, than within it; but, where preventive means can take place, this is certainly the best, and the most frequently successful.

"The second intention, viz. the discharge of matter collected under the cranium, can be answered only by the perforation of it."

"When, from the symptoms and appearances already described, there is just reason for supposing matter to be formed under the skull, the operation of perforation cannot be performed too soon; it seldom happens that it is done soon enough."

In short, whenever the *dura mater*, after the head has received external violence, separates, or is detached spontaneously from the bone underneath it, and such separation is attended with the collection of a small quantity of thin, brown ichor, an alteration of colour in the separated pericranium, unnatural dryness of the bone, chilliness, horripilation, languor, and some degree of fever, Mr. Pott considers the operation indispensablely necessary to save the patient's life.

"When the skull has been once perforated, and the dura mater thereby laid bare, the state of the matter must principally determine the surgeon's future conduct. In some cases, one opening will prove sufficient for all necessary purposes; in others, several may be necessary."

Notwithstanding the operation of perforation be absolutely and unavoidably necessary, as Mr. Pott remarks, "the repetition of bloodletting or cooling laxative medicines, the use of antiphlogistic remedies, and a most strict observance of a low diet and regimen, are indispensably requisite after such operation as before; the perforation sets the membrane free from pressure, and gives vent to collected matter, but nothing more; the inflamed state of the parts under the skull, and all the necessary consequences of such inflammation, call for all our attention, full as much afterward as before; and although the patient must have perished without the use of the trephine, yet, the merely having used it, will not preserve him, without every other caution and care. (Pott.)

I think it not improper to recommend again the practice of applying cold wet cloths to the head for the prevention and relief of inflammation of the dura mater; a plan to which, as already explained, Schmucker ascribed a good deal of the success with which he treated injuries of the head. It is favourably mentioned by Dr. Hennen, and has received the recommendation of another modern writer, whose opinion must have great weight: "in the inflammation, which succeeds slowly to injuries of the head, a species of inflammation not more insidious in its approach, than dangerous in its consequences, cold is by far the most efficacious remedy that has yet been discovered." (See *Thomson's Lectures on Inflammation*, p. 181.)

Both tables of the skull sometimes exfoliate in consequence of external violence. The dead bone must be removed, as soon as loose; and, if necessary, the scalp divided for the purpose.

3. Fissures and Fractures of the Cranium, without depression.

Fractures of the cranium are divisible into "those, in which the broken parts keep their proper level, or equality of surface, with the rest of the skull, and those in which they do not; or, in other words, fractures without depression, and fractures with."

"These two distinctions are all which are really necessary to be made, and will be found to comprehend every violent division of the parts of the skull (not made by a cutting instrument) from the finest capillary fissure, up to the most complicated fracture."

No truth in surgery is now better understood, and established, than that the bad symptoms very frequently accompanying a broken skull, are not produced by the breach made in the bone; nor indicate such breach to have been made. "They proceed, (as Mr. Pott correctly observes,) from an affec-

tion of the brain, or from injury done to some of the parts within the cranium, independent of any ill which the bones composing it may have sustained. They are occasioned by violence offered to the contents of the head in general; are quite independent of the mere breach made in the bone; and either do or do not accompany fracture, as such fracture may happen to be, or not to be complicated with such other ills.

"They are frequently produced by extravasations of blood, or serum, upon, or between the membranes of the brain; or by shocks, or concussions of its substance, in cases where the skull is perfectly entire and unhurt. On the other hand, the bones of the skull are sometimes cracked, broken, nay, even depressed, and the patient suffers none of these symptoms. In short, as the breach made in the bone is not, nor can be the cause of such complaints, they ought not to be attributed to it; and that for reasons, which are by no means merely speculative. For the practitioner who supposes, that such symptoms do necessarily and certainly imply, that the cranium is fractured, must regulate his conduct by such supposition, and remove the scalp, very often without either necessity or benefit; that is, without discovering what he looks for; and, on the other hand, if he does find the skull to be broken, believing all these complaints to be caused by, and deducible from the fracture, he will most probably pay his whole attention to that supposed cause, and may think, that when he has done what the rules of his art prescribe for such case, he has done all that is in his power:—an opinion not unfrequently embraced; and which has been the destruction of many a patient. For, as on one hand, the loss of sense, speech, and voluntary motion, as well as the hemorrhage from the nose, ears, &c. are sometimes totally removed by, or at least disappear, during the use of free and frequent evacuation, without any operation on the scalp or skull: so, on the other, as these symptoms and appearances are not produced by the solution of continuity of the bone, they cannot be remedied by such surgical treatment as the mere fracture may require.

"If any one doubts the truth of this doctrine, (continues Mr. Pott,) I would desire him to consider the nature, as well as most generally successful method of treating these symptoms; and at the same time, to reflect seriously on the operation of the trepan, as practised in simple, undepressed fractures of the skull.

"The sickness, giddiness, vomiting, and loss of sense and motion, can only be the consequence of an affection of the brain, as the common sensorium. They may be produced by its having been violently shaken, by a derangement of its medullary structure, or by unnatural pressure made by a fluid extravasated on its surface, or within its ventricles; but never can be caused by the mere division of the bone, (considered abstractedly;) which division, in a simple

fracture, can neither press on, nor derange the structure of the parts within the cranium.

"If the solution of continuity in the bone be either produced by such a degree of violence, as hath caused a considerable disturbance in the medullary parts of the brain, or has disturbed any of the functions of the nerves going off from it; or has occasioned a breach of any vessel or vessels, whether sanguine or lymphatic, and that hath been followed by an extravasation, or lodgment of fluid; the symptoms necessarily consequent upon such derangement, or such pressure, will follow: but they do not follow, because the bone is broken, their causes are superadded to the fracture, and although produced by the same external violence, are yet perfectly and absolutely independent of it: so much so, that they are frequently found where no fracture is.

"The operation of the trepan is frequently performed in the case of simple fractures, and that very judiciously and properly; but is not performed, because the bone is broken or cracked: a mere fracture, or fissure of the skull, can never require perforation, or that the dura mater under it be laid bare; the reason for doing this, springs from other causes than the fracture, and those really independent of it; they spring from the nature of the mischief which the parts within the cranium have sustained, and not from the accidental division of the bone. From these arise the threatening symptoms; from these all the hazard; and from these, the necessity, and vindication of performing the operation of the trepan.

"If a simple fracture of the cranium was unattended in present with any of the before-mentioned symptoms, and there was no reason for apprehending any other evil in future, that is, if the solution of continuity in the bone was the whole disease, it could not possibly indicate any other curative intention, but the general one in all fractures, viz. the union of the divided parts." (Pott.)

I could relate numerous examples to the point, if it were any longer necessary, in the present state of surgical knowledge, to cite facts, in proof of the important truth, that the mere undepressed fissure, or fracture of the skull itself, cannot be the source of the immediate bad symptoms, but that, in these cases, the whole of the sudden peril arises from the manner in which the brain and its membranes have been hurt by the same violence, which caused the injury of the bone. Professor Thomson had opportunities of witnessing in the Netherlands several instances, which can leave no doubt upon the subject. "In some of the wounds, (says he) in which the head had been struck obliquely by the sabre, portions of the cranium had been removed, without the brain appearing to have sustained much injury. In one case of this kind, where a considerable portion of the upper part of the occipital bone, *along with the dura mater*, had been removed, a tendency to protrusion of the brain took place during an attack of inflam-

mation; a slight degree of stupor with loss of memory occurred; but on the inflammatory state having been subdued, the brain sunk to its former level, the stupor went off, and the memory returned:"—and in another remarkable sabre cut, more than an inch in breadth of the left lobe of the cerebellum was exposed, and *was seen pulsating for a period of eight weeks*, yet the injury was unaccompanied with any particular constitutional symptoms. (See *Observations made in the Military Hospitals of Belgium*, p. 50, 51.)

In many cases of simple undepressed fractures of the cranium, it is true, that trephining is necessary: but the reasons for the operation, in these instances, are, first, the immediate relief of present symptoms arising from the pressure of extravasated fluid; and, secondly, the discharge of matter, formed between the skull and dura mater, in consequence of inflammation. The operation of trephining was also recommended by Pott, as a *preventive* of ill consequences; a practice, however, which is now never adopted by the most eminent surgeons; and many writers of the highest reputation, especially Desault, Dease, Mr. John Bell, and Mr. Abernethy, urgently and properly remonstrate against the method.

The latter remarks: "In the accounts which we have of the former practice in France, it is related, that surgeons made numerous perforations along the whole track of a fracture of the cranium; and, as far as I am able to judge, without any clear design. Mr. Pott also advises such an operation, with a view to prevent the inflammation and suppuration of the dura mater, which he so much apprehended. But many cases have occurred of late, where, even in fractures with depression, the patients have done well without an operation."

Mr. Abernethy next relates several cases of fracture of the cranium with depression, which terminated favourably, although no operation was performed. This judicious surgeon thinks that these cases, as well as a great many others on record, prove that at all events a slight degree of pressure may not derange the functions of the brain, for a limited time after its application, and in this circumstance probably never; for all those patients, whom he had an opportunity of knowing, for any length of time after the accident, continued as well as if nothing of the kind had happened to them. In Mr. Hill's cases in surgery, two instances of this sort are related, and Mr. Hill knew both the patients for many years afterward; yet no inconvenience arose. Indeed, it is not easy to conceive, that the pressure, which caused no ill effects at a time, when the contents of the cranium filled its cavity completely, should afterward prove injurious, when they have adapted themselves to its altered size and shape. Severe illness, it is true, often intervenes between the receipt of the injury, and the time of its recovery; and many surgeons might be inclined to attribute this to pressure; but it equally occurs when the depressed portion

is elevated. If a surgeon, prepossessed with the opinion, that elevation of the bone is necessary in every instance of depressed cranium, should have acted upon this opinion in several of the cases which Mr. Abernethy has related, and afterward have employed proper evacuations, his patients would probably have had no bad symptoms, and he would naturally have attributed their well-doing to the mode of treatment which he had pursued: yet these cases did equally well without an operation. (See *Abernethy's Surgical Works*, Vol. 2, p. 4, &c. 8vo. Lond. 1811.)

Depressed fractures of the skull not being our immediate consideration, we need not expatiate upon them; but it seemed right to make the preceding remarks, in order to show how unnecessary it must be to trephine a patient, merely because there is a fracture in the cranium, and with a view of preventing bad consequences. Even when the fracture is depressed, it is not necessary, unless there are evident signs, that the degree of pressure, thus produced on the brain, is the cause of existing bad symptoms.

The inflammation and suppuration of the parts, beneath the skull, which Mr. Pott wished so much to prevent by trephining early, do not arise from the occurrence of a breach in the cranium, but are the consequences of the same violence, which was the occasion of the fracture. Hence, it is obvious, that removing a portion of the bone cannot in the least prevent the inflammation and suppuration, which must result from the external violence which was first applied to the head; but on the contrary, such a removal being an additional violence, must have a tendency to increase the inevitable inflammatory mischief.

From what has been said, it is not to be inferred, however, that trephining is never proper, when there is a simple undepressed fracture of the skull. Such injury may be joined with an extravasation of blood on the dura mater; or it may be followed by the formation of matter between this membrane and the cranium; in both which circumstances, the operation is essential to the preservation of the patient, immediately, but not before the symptoms indicative of the existence of dangerous pressure on the brain, begin to show themselves. (See *Trephine*.)

A fracture of the skull, unattended with urgent symptoms, and not brought into the surgeon's view by any accidental wound of the integuments, often remains for ever undiscovered; and as no benefit could arise from laying it bare by an incision, such practice should never be adopted. The surgeon ought only to be officious in this way, when he can accomplish by it some better object, than the mere gratification of his own curiosity. And as we shall find from the perusal of this article, and the one entitled, *Trephine*, that in these cases, the removal of pressure off the surface of the brain is the only possible reason for ever perforating the cranium with this instrument; and as dividing the scalp is only a useful mea-

sure, when it is preparatory to such operation; neither the one nor the other should ever be practised, unless there exist unequivocal symptoms, that there is a dangerous degree of pressure operating on the brain, and caused either by matter, extravasated blood, or a depressed portion of the skull. If any exceptions can be made to this observation, they are cases, in which it is advisable to remove loose splinters and fragments of bone, or balls plainly felt under the scalp.

The true mode of preventing the bad effects frequently following, but not arising from simple fractures of the skull, is not to trephine, but to put in practice all kinds of antiphlogistic means. For this purpose, let the patient be repeatedly and copiously bled, both from the arm and temporal arteries; let him be properly purged; give him antimonials; keep him on the lowest diet; let him remain in the most quiet situation possible; and if, notwithstanding such steps, the symptoms of inflammation of the brain continue to increase, let a large blister be applied to the scalp. These are the cases, also, in which the topical application of cold water to the shaved and naked head, by means of cloths kept constantly wet, is an eligible, though in this country, a much neglected practice. Numerous instances, however, in favour of the method are recorded by the experienced Schmucker, (see his *Chirurgische Wahrnehmungen*, B. 1, Berlin, 1774.) and the trials which I have seen made of it, give me a high opinion of its superior efficacy. When, in spite of all these measures, matter forms under the cranium, attended with symptoms of pressure, a puffy tumour of the injured part of the scalp, or those changes of the wound, if there is one, which Mr. Pott has so excellently described, and we have already related; not a moment should be lost in delaying to perforate the bone with the trephine, and giving vent to the matter beneath.

4. *Fractures of the Cranium with Depression.*

In simple fractures of the skull, or those in which the parts of the broken bone are not depressed from their situation, Mr. Pott remarks, that "The surgical intention and requisite treatment are the same in each, viz. to procure a discharge for any fluid which may be extravasated in present, (provided the pressure of such extravasation produces urgent symptoms, a condition which should here be added,) and to guard against the formation, or confinement of matter." The prevention of suppuration will, as we have already remarked, be best accomplished, not by perforating the cranium, as Mr. Pott advised, but by copious bleeding, evacuations, cold washes to the head, blisters, and a rigorous antiphlogistic regimen. However, the confinement of matter, producing symptoms of pressure on the brain, certainly indicates the immediate use of the trephine.

"But, says this author, in fractures attended with depression, there are other intentions. In these the depressed parts are to be elevated, and such as are so separated as to

be incapable of reunion, or of being brought to lie properly, and without pressing on the brain, are to be totally removed. These circumstances are peculiar to a depressed fracture; but although they are peculiar, they must not be considered as sole, but as additional to those which have been mentioned at large under the head of simple fracture: commotion, extravasation, inflammation, suppuration, and every ill which can attend on, or be found in the latter, are to be met with in the former, and will require the same method of treatment." That loose splintered pieces of the cranium, when quite detached, and already in view, in consequence of the scalp being wounded, ought to be taken away, no one will be inclined to question. That they ought also to be exposed by an incision, even when the scalp is unwounded, and then taken away, whenever they cause symptoms of irritation, or pressure, I believe, will be universally allowed. But the reader will already understand, from what has been said in the preceding section, that several excellent surgeons do not coincide with Pott, in believing that every depressed fracture of the skull necessarily demands the application of the trephine.

"There certainly are (says Mr. Abernethy) degrees of this injury, which it would be highly imprudent to treat in this manner. Whenever the patient retains his senses perfectly, I should think it improper to trephine him, unless symptoms arose that indicated the necessity of it." (P. 21.)

It is extraordinary and unaccountable, but it is not less true, that no calculation of the bad effects can be made by the degree in which a part of the skull is depressed. This is a fact which has been long known. It has also been particularly adverted to by an eminent modern writer. "Various instances also presented themselves, in which, though a considerable degree of compression must have been occasioned, sometimes by the depression of both tables, and at other times by the depression of the inner table only of the skull, yet neither stupor, paralysis, nor loss of memory were produced. In one of these cases, the middle of the right parietal bone was fractured, and considerably depressed by a ball, which was extracted on the twentieth day. In this case, neither stupor nor paralysis appeared. In another, a musket-ball had struck the right parietal bone, fractured it, and was flattened and lodged between the tables of the skull. The inner table was much depressed, yet no bad symptoms supervened." (See *Thomson's Observations made in the Military Hospitals in Belgium*, p. 59, 60.) The same author also saw a singular case, in which a ball, entering behind the right temple, and passing backwards and downwards, had fractured the bones in its passage, and lodged in the surface of the brain, over the tentorium, from which place it was extracted on the seventeenth day after the injury. No bad symptom had manifested itself previously to the operation, and the man recovered under the strictest antiphlo-

gistic regimen, with little or no constitutional derangement. Dr. Hennen has recorded two cases, fully proving the correctness of Mr. Abernethy's opinion about the impropriety of using the trephine in cases of depression, unattended with urgent symptoms: in one of these instances, the upper and posterior angle of the parietal, which had been struck by a musket-ball, was depressed exactly *an inch and a quarter from the surface of the scalp, yet no bad symptoms followed*, and with the aid of bleeding and other antiphlogistic remedies, the soldier recovered perfectly in a few weeks. "In a similar case, where the man survived thirteen years, with no other inconvenience than occasional determination of blood to the head on hard drinking, *a funnel-like depression to the depth of an inch and a half was formed in the vertex.*" (See *Hennen's Military Surgery*, p. 287, Ed. 2.)

If then the violence of the symptoms is not always in proportion to the compression, but is sometimes considerable when the pressure is slight, every surgeon cannot be too fully impressed with the following truth, that *existing symptoms of dangerous pressure on the brain, which symptoms will be presently related, can alone form a true reason for perforating the cranium.* The mode of operating, in order to elevate depressed portions of the skull, is explained in the article, *Trephine.*

In military surgery, particular cases present themselves, which scarcely admit of being comprehended within the tenor of any general rules and principles. Thus, it sometimes happens, that a ball breaks the os frontis, and the whole or a part of it lodges in the frontal sinus, with or without fracture of the inner boundary of this cavity. In cases of this description, Baron Larrey recommends exposing the course of the fracture by a free incision, and the use of the trephine for the removal of the extraneous body. When the inner side of the sinus was found broken and depressed, he next perforated that part of the cavity with a small conical trephine, took away such pieces of bone as required removal, and let out any extravasated blood. Sometimes, however, the front of the sinus is so splintered, that the fragments, when taken away with the forceps, leave the cavity sufficiently opened, not only for the extraction of the ball, but for the application of the trephine to the inside of the sinus, as we find exemplified in one of the two cases of this nature, which Larrey met with in the Egyptian campaign. (*Mém. de Chir. Militaire*, T. 2, p. 138.) After the battle of Witepsk, in 1812, he was called to two Russian soldiers, whose cases were remarkable; one of them had been struck above the right eyebrow with a grape-shot, which, after breaking and penetrating the frontal bone, entered the cavity of the cranium, so as to lodge upon the anterior right lobe of the brain, and the orbital process and internal crista of the os frontis. Notwithstanding the large size of the ball, little of it could be seen externally, and the aperture through

which it had passed, was not more than three or four lines broad : every attempt to extract it, therefore, was vain. The patient experienced a painful sense of oppression and weight in the head, and whenever he inclined it backward, was seized with syncope. He kept himself constantly in a sitting posture, with his head on his knees. Larrey adds, that every symptom of compression of the brain also prevailed, though this account is rather difficult to comprehend, considering that the patient could sit up, and choose his posture. As for any description given by himself, of his sufferings, that is another circumstance on which I should not be inclined to dwell, supposing, that probably the Baron was not able to converse in the Russian language, and that the inferences, respecting the man's feelings, were made in some other way. But whatever might be the real state of the symptoms, (and in a case of this kind a correct account of them would have been interesting,) the ball was plainly ascertained, by means of a probe, to be of iron, and of much larger diameter than the opening, through which it had entered; and, that for the purpose of extracting it, the application of the trepan was urgently necessary. The fracture was fairly brought into view by suitable incisions, three perforations were made with a small trephine at its upper part, and after the removal of the angles of the bone between these perforations, the ball, which weighed seven French ounces, was readily extracted with the aid of a strong pair of forceps, and an elevator. A considerable quantity of coagulated blood was also removed, under which the brain was found with a depression of three or four lines deep. As soon as some splinters of the bone had been taken away, the part was dressed with a bit of fine linen dipped in warm wine, sweetened with sugar, over which were placed charpie, several compresses, and a bandage. With respect to the application of warm wine, and other stimulants, to the surface of the brain, in wounds exposing or interesting that organ, it seems to be an invariable practice with Larrey, as well as Schmucker, and the older surgeons. On what principle the custom is still kept up? and whether it is truly right and useful? are questions which may be rationally put. In whatever way experience may hereafter decide these matters, suffice it to add, that the patient was relieved by the treatment, and fell into a quiet sleep for two hours; but in the evening he became feverish, and the wound acutely painful. A considerable quantity of blood was taken from the vena saphena, (and why bleeding was not practised at first, seems extraordinary.) The dressings, which according to my ideas, were highly objectionable, were removed, and a large emollient poultice applied. Cooling beverages, containing a small quantity of tartarized antimony, and antispasmodic anodyne medicines, were prescribed. The following day, the patient's state appeared satisfactory, without the slightest disturbance of the senses, and in due time, he perfectly recovered.

The other soldier had been wounded in the left temple, with a lead ball, five days before Larrey saw him. One half of the ball had gone into the cranium, through a very narrow breach; the other had burrowed under the temporal muscle, and lodged near the mastoid process. The right side of the body was paralytic, the senses were annihilated, and the man was in a state of incessant agitation. After dilating the wound in the temple, and exposing the fracture, Larrey discovered the track of the piece of lead, which had gone towards the mastoid process, and which he immediately extracted by a counter-opening. At the lower part of the temporal wound, he applied a trepan very near the spot where the other portion of the ball was lodged. This, with some fragments of the bone, and extravasated blood, was easily extracted. The patient, however, was not saved; a circumstance ascribed by Larrey, to the operation having been done too late.

In another case, one of the Imperial Guards, wounded at the battle of Moskowa, died with symptoms of compression, and, after death, a quarter of a bullet, and a fragment of bone, were found under the skull, attended with an ulcerated (or wounded) state of the adjacent portion of the brain. Larrey very properly expresses his opinion, that this soldier would have had a chance of being saved, had the trepan been used. (*See Mém. de Chir. Mil. T. 4, p. 183, &c.*) The practice of trephining for the removal of balls, situated near a fracture of the skull, within this bony cavity, or lodged among the fragments, or between the two tables, forced asunder, (see *Engel's Case in Vermischte Chir. Schriften von J. L. Schmucker. B. 1, p. 242.*) is not peculiar to Larrey, for it has been done by many other surgeons, (see *Schmucker's Wahrnehmungen, B. 1, p. 298*; but, I do not know, that he has been anticipated in his bold practice of making a counter-opening in the skull, when the ball is lodged at such distance from the fracture, that it cannot be extracted through any perforation made in the vicinity of the original injury; for, it is a principle, which he ventures to lay down, that *when a ball has entered the cranium, without quitting the root of this cavity, the case is one requiring the application of the trepan.* *Mém. de Chir. Mil. T. 4, p. 180.*) In the 2d vol. of this work, (p. 139,) the reader will find the account of a soldier, who was struck on the middle of the forehead with a ball, which penetrated the os frontis, and then passed obliquely backwards, between the skull and the dura mater, in the course of the longitudinal sinus, as far as the lambdoidal suture, where it stopped. Larrey traced the situation of the ball, by the introduction of an elastic gum catheter into the opening and measuring the distance between the fracture and the place, where he felt the ball, he cut down upon that part of the skull, beneath which he concluded that the ball was lodged. The bone was then perforated with a large trepan; a good deal of pus was discharged; the ball was extracted, and the patient recovered.

One thing here merits the attention of surgeons: Larrey tells us, that a good deal of pus issued as soon as an opening was made in the skull; there must then have been suppuration under the bone, and inflammation and detachment of the dura mater; circumstances always indicated, according to Pott, by a corresponding separation of the pericranium, and a puffy tumour of the scalp. Did these symptoms take place in the foregoing case, so as to be of any assistance to Larrey, in judging of the place where the ball was lodged? And, has the mention of them been omitted only by accident? or, are we to infer, that suppuration may happen between the cranium and dura mater, without any detachment of the pericranium and puffy tumour of the scalp; a thing, which Bichat asserts, is proved by daily experience in the Hôtel-Dieu, at Paris? (See *Œuvres Chir. de Desault*, T. 2, p. 29.) Larrey, in his 3d vol. p. 82, gives us another case, in which a ball pierced the left parietal bone, and lodged near the lambdoidal suture. Its situation was detected with the aid of an elastic gum catheter, and partly in consequence of there being a slight ecchymosis over the part. Here a crucial incision was made through the scalp, and a small fissure discovered. As the symptoms of compression increased, the trepan was applied, so as to include the fissure. A half of the ball flattened was found directly under the perforation, and a good deal of blood was voided from the two openings in the cranium. For a fortnight, the case went on favourably, but the patient was then attacked with what Larrey terms hospital fever, but which, in all probability, was inflammation and suppuration of the membranes of the brain, and died.

The records of surgery furnish numerous instances, in which the patients lived a considerable time with balls lodged in the cavity of the cranium. Thus, one is related by Paroisse, where the patient soon recovered his senses after the injury, and at the end of six months, felt no inconvenience, except a difficulty of opening the mouth (*Opusculs de Chir. Obs.* 1, 8vo. Paris, 1806.) Ramdohr has published another case, where a soldier was shot through the frontal sinus, and the ball was found after death in the medullary substance of the left hemisphere of the brain, half an inch above the ventricle: yet, this patient lived four months after the injury, and soon recovered his senses after its occurrence. For a considerable part of this time, he was also free from any bad symptoms. At last, he was affected with a kind of stupor, and an inability to open his left eye, and fell into a lethargic, and convulsed state. (*Schmucker Vermischte Chir. Schriften*, B. 1, p. 277.) A French soldier, at the battle of Waterloo, was wounded with a musket-ball, which entered at the anterior portion of the squamous suture, lodged in the substance of the brain, and on the fifth day, after an enlargement of the wound, and the removal of several fragments of bone,

was extracted from the posterior lobe of the right hemisphere of the brain, where it was found resting on the tentorium. Yet, during the several previous days, the man, with the exception of a slight headach, and partial deafness of the right ear, seemed to enjoy perfect health. The case ended well. (See *Hennen's Mil. Surg.* p. 289. Ed. 2.) Still more remarkable instances of the duration of life, and even of the absence of very serious symptoms, after great and serious wounds of the brain, and the lodgment of balls, might here be cited; but, it will suffice to refer to the instructive Essay of M. Quesnay, on the subject, in vol. 1, of the *Mém. de l'Acad. de Chir.* 4to. and to the account of twenty-two French soldiers, whose vertices, with more or less of the brain, were cut off by sabre strokes. All these men ultimately died; but, at first, had not a single bad symptom, and performed a journey of thirty leagues after being wounded, and one half of this distance on foot. (See *Paroisse Opusculs de Chir.* p. 41, &c.)

5. Extravasation under the Cranium, Symptoms of Pressure on the Brain, &c.

Mr. Pott remarks, "the shock, which the head sometimes receives by falls from on high, or by strokes from ponderous bodies, does not unfrequently cause a breach in some of the vessels, either of the brain, or its meninges; and thereby occasions extravasation of the fluid, which should circulate through them. This extravasation may be the only complaint produced by the accident; or it may be joined with, or added to, a fracture of the skull. But this is not all, for it may be produced not only when the cranium is unhurt by the blow, but even when no violence of any kind has been offered to, or received by the head."

The effused blood may lie between the cranium and dura mater, between the latter membrane and the pia mater; or in the substance, or cavities of the brain. The first species of extravasation, which is observed to be always more or less circumscribed, may occur at any part of the skull, but when situated at its base, is generally fatal. In the second, the blood is widely scattered about between the dura mater and arachnoides; and on this account, unless its quantity be very considerable, it does not cause any great degree of pressure. In the third example, if the blood be situated in the convolutions, it is also widely diffused, but if it be within the substance, or ventricles, of the brain, it is circumscribed (*Œuvres Chir. de Desault par Bichat*, T. 2, p. 23.) Sometimes, in cases of great violence, as Mr. Pott has justly observed, the blood is found at the same time in all these different parts.

When the blood is extravasated beneath the skull, the violence, which produces the rupture of the vessel, usually stuns the patient, from which state provided the quantity and pressure of the blood, and the force of the concussion be not too great, he gradually recovers, and regains his senses. If the first extravasation be trivial, the patient, after re-

gaining his senses, may only feel a little drowsiness, and go to bed. The bleeding from the ruptured vessel continuing, and the pressure on the brain increasing, he becomes more and more insensible, and begins to breathe in a slow, interrupted, stertorous manner. In cases of compression, whether from blood or a depressed portion of the skull, there is a general insensibility; the eyes are half open, the pupils dilated, and motionless, even before the vivid light of a candle; the retina is insensible; the limbs relaxed; the breathing stertorous; the pulse slow, and, according to Mr. Abernethy, less subject to intermission, than in cases of concussion. The absence of stertor, however, as this gentleman admits, must not be relied upon, as a proof of there being no compression; for, Morgagni relates dissections of apoplectic persons, in whom the effusion was considerable, yet no stertor occurred.

In a case of wound of the posterior part of the skull, with depression, seen by Dr. J. Thomson, the pulse at one time sunk as low as 36 strokes in a minute. This eminent professor, however, is at variance with Mr. Abernethy upon one point, by stating, that irregularity of the pulse is a very frequent attendant upon compressed brain. (*Report of Observations, &c. p. 54, 55.*) Sometimes convulsions arose from the pressure of portions of the skull, driven in upon the brain. This is a very dangerous symptom; but Dr. Thomson saw it cease in a few examples, after the depressed piece of bone had been elevated, and the antiphlogistic regimen adopted. (P. 60.) Convulsions, I am disposed to regard with Bichat, rather as a symptom of injury of the brain, than of compression. (*Œuvres Chir. Desault, T. 2, p. 27.*)

Indeed, the difficulty of the diagnosis of many cases may be well conceived by what Dr. Hennen remarked, in his practice, viz. that, in some instances, the pupils were contracted, in others dilated, where the injury was nearly of a similar nature and degree; while, sometimes, in the same patient, one pupil was dilated, and the other much contracted. He saw, also, paralysis occur on one side, and convulsions on the other, when the blow had been on the forehead, and the same when it had been on the occiput. (*Op. cit. p. 300, 301.*)

The patient is hardly ever sick, when the pressure on the brain and the general insensibility, are considerable; for the very action of vomiting betrays sensibility in the stomach and œsophagus. These symptoms are not peculiar to pressure from blood, but arise also from that of many depressed fractures of the skull, and of supuration under this part. They are all attributable to the unnatural pressure made on the brain and nerves, and have too often been mistaken, as indications of an injury, which, considered abstractedly, can never cause them; we allude to a simple undepressed fracture of the cranium, which may be accompanied with them, but cannot cause them. They differ in degree, according to the quantity, kind,

and situation of the pressing fluid. The hemorrhage from the nose and ears, which often follows violence applied to the head, leads to no particular or useful inference: we cannot even calculate, by this sign, that the force has exceeded a certain degree; for, such bleedings take place, in some persons, from much slighter causes than in others.

Paralysis is a symptom, which generally attends hurtful pressure on the brain. The particular circumstances, however, which determine its degree, extent, and situation, are not well understood. "In some instances of paralysis from sabre-wounds, as well as in those made by gunshot, (says Dr. J. Thomson) paralysis was confined to the upper, and in others to the lower extremity. In every instance, in which it distinctly appeared that the injury existed on one side of the head, the paralysis uniformly manifested itself upon the other; but, we were unable to perceive any other fixed relation, between the part of the brain, which had been injured, and the part of the body affected with palsy. A wound of the right parietal bone by a musket-ball was followed by palsy of the left arm and leg. In another case, a wound, penetrating the upper part of the right parietal bone, was accompanied with a slight paralytic affection of the left side of the mouth, and complete palsy of the left leg. In a third case, a sabre-wound of the same bone, followed by extensive exfoliations, gave rise to a complete palsy of the left side." (*Observations made in the Military Hospitals in Belgium, p. 52, 53.*)

With respect to paralysis, it is unquestionably one of the common symptoms of pressure on the brain; but, according to Bichat, it may also be caused by concussion; and we know, that it may arise in cases of inflammation and supuration, within the skull. The above statement respecting the paralysis being always on the side of the body opposite that on which the brain is compressed, agrees with what is generally remarked by other surgical writers. (See *Larrey's Mém. de Chir. Mil. T. 4, p. 180; Hennen's Principles, p. 301, Ed. 2, &c.*) Yet, at the Hôtel Dieu, at Paris, says Bichat, extravasation has very often been found both on the side affected with paralysis, and the opposite one; or else the blood was generally diffused, while the paralysis was local. (*Œuvres Chir. de Desault, T. 2, p. 27.*)

The preceding class of symptoms only informs us, that the brain is suffering compression, and leaves us quite in the dark respecting several other very important circumstances. "We not only have no certain infallible rule, whereby to distinguish what the pressing fluid is, or where it is situated, but we are, in many instances, absolutely incapable of knowing, whether the symptoms be occasioned by any fluid at all; for, a fragment of bone broken off from the internal table of the cranium, and making an equal degree of pressure, will produce exactly

the same complaints." (Pott.) In detailing the symptoms of pressure from blood, I took particular notice of the patient being at first generally stunned by the blow; of his gradually regaining his senses, and of his afterward relapsing into a state of insensibility again. The interval of sense, which thus occurs, was pointed out by Petit as a circumstance of the greatest consequence in elucidation of the nature of the case.

"A concussion, and an extravasation (as Mr. Pott observes,) are very distinct causes of mischief, though not always very distinguishable.

"M. Le Dran, and others of the modern French writers, have made a very sensible and just distinction between that kind and degree of loss of sense which arises from a mere commotion of the brain, and that which is caused by a mere extravasation, in those instances, in which the time of the attack, or appearance of such symptoms, are different, or distinct. The loss of sense, which immediately follows the violence, say they, is most probably owing to a commotion; but that which comes on after an interval of time has past, is most probably caused by extravasation.

"This distinction is certainly just and good, as far as it will go. That degree of abolition or diminution of sense, which immediately attends or follows the blow or fall, and goes off again without the assistance of art, is in all probability occasioned by the sudden shake, or temporary derangement of the contents of the head; and the same kind of symptoms recurring again some time after they had ceased, or not coming on until some time has passed from the receipt of the violence, do most probably proceed from the breach of a vessel within or upon the brain. But unluckily, we have it not very often in our power to make this exact distinction. An extravasation is often made so immediately, and so largely, at the instant of the accident, that all sense and motion are instantaneously lost, and never again return. And it also sometimes happens, that although an extravasation may possibly not have been made at the moment of the accident, and the first complaints may have been owing to commotion merely, yet a quantity of fluid having been shed from its proper vessels very soon after the accident, and producing its proper symptoms, before those caused by the commotion have had time to go off, the similarity of the effects of each of these different causes is such, as to deprive us of all power of distinguishing between the one and the other, or of determining with any tolerable precision, to which of them such symptoms as remain are really owing."

As Bichat remarks, a man meets with a fall; a slight concussion of the brain is the consequence, and the patient is instantly stunned. The effects of concussion gradually subside, but an extravasation takes place, and the loss of the senses continues, though from a different cause. Here, according to the principles of Petit, the case

would be set down as concussion; yet, things are quite the contrary, the extravasation now keeping up the symptom, which was only temporarily produced by concussion. In many instances also the effects of concussion and extravasation exist together, and then how is a surgeon to judge of the nature of the case? (See *Œuvres Chir. de Desault*, T. 2, p. 25.)

"When an extravasation of any kind is made, either upon or within the brain, if it be in such quantity, or so situated, as to disorder the economy of the animal, it always produces such disorder, by making an unnatural pressure on the parts where it lies. The nature and degree of the symptoms, hereby produced, are various and different in different persons, according to the kind, quantity, and situation of the pressing fluid. Sometimes it is mere fluid blood, sometimes blood in a state of coagulation, sometimes it is a clear lymph, and at others blood and water are found mixed together; each of these is found either simple or mixed in different situations, that is, between the skull and dura mater, between the dura and pia mater, or in the natural cavities of the brain, called its ventricles, and sometimes, in cases of great violence, they are found at the same time in all these different parts. Sometimes a considerable quantity is shed instantly, at the time of the accident; and sometimes the breach by which the effusion is made is so circumstanced, both as to nature and situation, that it is at first very small, and increases by faster or slower degrees. In the former, the symptoms are generally immediate and urgent, and the extravasation is of the bloody kind; in the latter, they are frequently slight at first, appear after some little interval of time, increase gradually till they become urgent or fatal, and are in such case generally occasioned by extravasated lymph. So that although the immediate appearance of bad symptoms does most certainly imply mischief of some kind or other, yet, on the other hand, no man ought to suppose his patient free from hazard, either because such symptoms do not show themselves at first, or because they appear to be but slight: those which come on late, or appearing slight at first, increase gradually, being full as much to be dreaded as to consequence, as the more immediately alarming ones; with this material difference between them, that the one may be the consequence of a mere concussion of the brain, and may by means of quietude and evacuation go quite off; whereas, the other being most frequently owing to an extravasation of lymph, (though sometimes of blood also) within the substance of the brain, are very seldom removed by art." (Pott.)

The case of extravasation between the cranium and dura mater, is almost the only one which admits of relief from trephining. Mr. Abernethy informs us, that in the cases which he has seen of blood extravasated, between the dura and pia mater, on a division of the former membrane being made

for its discharge, only the serous part of it could be evacuated: for the coagulum was spread over the hemisphere of the brain, and had descended as low as possible towards its inferior part, so that very little relief was obtained by the operation. (*Surgical Works, Vol. 2, p. 46.*) This statement, we see, is confirmed by that of Bichat.

Fractures of the cranium, which take place across the lower and front angle of the parietal bone, and the rest of the tract of the trunk, and large branches of the spinous artery of the dura mater, are cases very apt to be attended with a copious extravasation. This vessel, and others more deeply seated, however, may be ruptured, pour out a considerable quantity of blood, and induce urgent symptoms of pressure on the brain, not only without the co-existence of a fracture, but even of any external mark of violence on the scalp.

The effused blood is frequently situated below the part on which the violence has operated, and hence, when such part is pointed out by a wound, or discoloration of the scalp, or a fracture, and the symptoms of pressure are considerable, I should have no hesitation about immediately trephining, in the situation of the external injury. I have seen many cases, in which such practice was justified by the result, and even when no extravasation exists, this plan will sometimes detect a depression of the inner table of the skull, and be the means of saving life, as happened in one very remarkable case, which I trephined at Brussels, after the battle of Waterloo. At the same time, it would be wrong to hold out the expectation, that, by acting on this principle, the surgeon will always find blood immediately under the part of the cranium which he perforates. With respect to a fracture also, as a guide to the place for the application of the trephine in cases of extravasation, Desault regards it as very fallacious, dissections proving that numerous fractures of the skull are unattended with any effusion of blood immediately under them; and his experience taught him, that the most frequent cases were those, in which there was either extravasation without fracture, or a fracture with blood effused in a part of the head remote from the injury of the bone. (*Euvres Chir. T. 2, p. 130.*) Even when blood is seen issuing from the fissure, he regards it as no proof of the dura mater being detached, as such blood may proceed from the vessels of the diploe. (*P. 31.*) But what is to be done, when dangerous symptoms of pressure prevail, without any external mark to denote what part of the head has received the blow, or whether any at all? for, a general concussion of the head may produce an effusion of blood within the cranium. Under these circumstances, Mr. Pott was against the operation, and says that "the only chance of relief is from phlebotomy, and an open belly; by which we hope so to lessen the quantity of the circulating fluids as to assist nature in the dissipation or absorption of what has been extravasated.

This is an effect which, although not highly improbable in itself, yet is not to be expected from a slight or trifling application of the means proposed. The use of them must be proportioned to the hazard of the case. Blood must be drawn off freely and repeatedly, and from different veins; the belly must be kept constantly open, the body quiet, and the strictest regularity of general regimen must be rigidly observed. By these means, very alarming symptoms have now and then been removed, and people in seemingly very hazardous circumstances, have been recovered." Desault also promulgated the same advice, and blamed the doctrine formerly in vogue, that it was better to apply the trephine many times uselessly, than to let a single extravasation remain undetected; for Desault was, convinced, that the trephine, when used on this principle, was a source of greater mischief, than the effused blood itself. (*Euvres Chir. T. 2, p. 34.*)

But should the mode of judging, whether blood lies immediately under the skull, suggested by Mr. Abernethy, prove invariably correct, the question, whether the trephine should be applied, or not, may in future be more easily determined. Even when the injured scalp shows where the violence has operated, the criterion about to be noticed, may inform us whether we should perforate the bone or not; for though the extravasation is sometimes found immediately under the external mark, yet it often is not so; but is in a part distant from that mark, to which situation we have nothing to lead us, and to which, indeed, if we knew it, we could not reach. Mr. Abernethy has observed, "that unless one of the large arteries of the dura mater be wounded, the quantity of blood, poured out will probably be considerable; and the slight compression of the brain, which this occasions, may not be attended with any peculiar symptoms, or perhaps it may occasion some stupor, or excite an irritation, disposing the subjacent parts to become inflamed. It is indeed highly probable, that in many cases, which have done well without an operation, such an extravasation has existed. But if there be so much blood on the dura mater as materially to derange the functions of the brain, the bone, to a certain extent, will no longer receive blood from within; and by the operation performed for its exposure, the pericranium must have been separated from its outside. I believe, that a bone so circumstanced, will not be found to bleed; and, I am at least certain, it cannot with the same freedom and celerity, as it does when the dura mater remains connected with it internally. (See *Abernethy's Surgical Works, Vol. 2, p. 47.*) In some cases related by this gentleman, there was no hemorrhage; twice he was able, by attending to this circumstance, to tell how far the detachment of the dura mater extended; and often, when symptoms seemed to demand a perforation of the skull, he has seen the operation contra-indicated by the hemorrhage

from the bone, and as the event showed, with accuracy. Mr. Abernethy admits, however, that in aged persons, and in those in whom the circulation has been rendered languid by the accident, the mode of distinction, which he has pointed out, will be less conclusive.

Pott remarks, that "if the extravasation be of blood, and that blood be in a fluid state, small in quantity, and lying between the skull and dura mater, immediately under or near to the place perforated, it may happily be all discharged by such perforation, and the patient's life may thereby be saved; of which many instances are producible. But if the event does not prove so fortunate, if the extravasation be so large or so situated that the operation proves insufficient, yet the symptoms having been urgent, general evacuation having been used ineffectually, and a wound or bruise of the scalp having pointed out the part which most probably received the blow: although the removal of that part of the scalp (a simple incision ought to have been said) should not detect any injury done to the bone, yet the symptoms still subsisting, I cannot help thinking, that perforation of the cranium is in these circumstances so fully warranted, that the omission of it may truly be called a neglect of having done that which might have proved serviceable, and *rebus sic stantibus*, can do no harm. It is very true, that no man can beforehand tell whether such operation will prove beneficial or not, because he cannot know the precise nature, degree, or situation of the mischief; but this uncertainty, properly considered, is so far from being a dissuasive from the attempt, that it is really a strong incitement to make it; it being fully as impossible to know, that the extravasated fluid does *not* lie between the skull and dura mater, and that under the part stricken, as that it *does*; and if the latter should be the case, and the operation be not performed, one, and most probably the only means of relief, will have been omitted."

When there is no interval of sense, between the blow, and the coming on of perilous symptoms, it is frequently impossible to determine, whether the mischief be owing to the largeness and suddenness of the extravasation, to the violence of the shock which the brain has received, or to both these causes at once, which unfortunately, is too often the case. In this latter complication, indeed, trephining will frequently be of no avail, even though it serve for the entire removal of all pressure off the brain; for the patient cannot recover from the violence of the concussion, and never regains his senses. This is no reason, however, why the chance of the operation doing good should not be taken, when there are evident symptoms of pressure. Let us, in these darkened cases, call to mind the sentiments of Pott, who says: "No man, who is at all acquainted with this subject, will ever venture to pronounce or promise success from the use of the trephine, even in the most

apparently slight cases; he knows that honestly he cannot; it is enough that it has often been successful where and when every other means have failed. The true and just consideration is this: does the operation of perforating the cranium in such case add at all to that degree of hazard which the patient is in before it is performed? or can he in many instances do well without it? If it does add to the patient's hazard, that is certainly a very good reason for laying it aside, or for using it very cautiously; but if it does not, and the only objection made to it is, that it frequently fails of being successful, surely it cannot be right to disuse that, which has often been, not only salutary, but the *causa sine qua non* of preservation, merely because it is also often unsuccessful, that is, because it is not infallible."

Giving vent to the confined blood "may produce a cure, or it may prove only a temporary relief, according to the different circumstances of different cases. The disappearance, and even the alleviation of the most pressing symptoms, is undoubtedly a favourable circumstance, but is not to be depended upon as absolutely portending a good event. Either a bloody, or limpid extravasation may be formed, or forming between the meninges, or upon or within the brain, and may prove as certainly pernicious in future, as the more external effusion would have done had it not been discharged; or the dura mater may have been so damaged by the violence of the blow as to inflame and suppurate, and thereby destroy the patient.

"If the disease lies between the dura and pia mater, mere perforation of the skull can do nothing; and therefore, if the symptoms are pressing, there is no remedy but division of the outer of these membranes. The division of the dura mater is an operation, which I have several times seen done by others, and have often done myself; I have seen it, and found it now and then successful; and from those instances of success, am satisfied of the propriety, and necessity of its being sometimes done." He next states, however, his sentiment, that wounding the dura mater is itself attended with dangerous consequences. Mr. Abernethy's opinion of such operation has already been given.

"Upon the removal of a piece of bone by means of the trephine; if the operation has been performed over the part where the disease is situated, and the extravasation be of the fluid kind, and between the cranium and dura mater; such fluid, whether it be blood, water, or both, is immediately seen, and is partly discharged by such opening; if, on the other hand, the extravasation be of blood in a coagulated or grumous state, it is either loose, or in some degree adherent to the dura mater; if the former of these be the case, it is either totally or partially discharged at the time of, or soon after the operation, according to the quantity or extent of the mischief; if the latter, the perforation discovers, but does not immediately

discharge it." Mr. Pott then lays it down as a rule, that a large extravasation must necessarily require a more free removal of bone than a small one; and a grumous or coagulated extravasation, a still more free use of the instrument.

All cases of pressure on the brain are attended with hazard of inflammation of this organ, and its membranes. The danger must be averted, as much as possible, by applying cold washes to the head, and employing free and repeated bleeding, leeches, antimonials, saline purgatives, and other antiphlogistic means.

CONCUSSION, OR COMMOTION OF THE BRAIN.

It is observed by Mr. Pott, that "very alarming symptoms, followed sometimes by the most fatal consequences, are found to attend great violence offered to the head; and upon the strictest examination, both of the living and the dead, neither fissure, fracture, nor extravasation of any kind can be discovered. The same symptoms, and the same event are met with, when the head has received no injury at all *ab externo*, but has only been violently shaken; nay, when only the body, or general frame, has seemed to have sustained the whole violence." And he afterward remarks, that "the symptoms attending a concussion are generally in proportion to the degree of violence which the brain itself has sustained, and which indeed, is cognizable only by the symptoms. If the concussion be very great, all sense and power of motion are immediately abolished, and death follows soon; but between this degree, and that slight confusion (or stunning as it is called,) which attends most violences done to the head, there are many stages." I am of opinion, that Mr. Abernethy has particularly excelled other writers, in his description of the symptoms of concussion, which he thinks may be divided into three stages.

"The first is, that state of insensibility and derangement of the bodily powers, which immediately succeeds the accident. While it lasts, the patient scarcely feels any injury that may be inflicted on him. His breathing is difficult, but in general without stertor; his pulse intermitting, and his extremities cold. But such a state cannot last long; it goes off gradually, and is succeeded by another, which I consider as the second stage of concussion. In this, the pulse and respiration become better, and though not regularly performed, are sufficient to maintain life, and to diffuse warmth over the extreme parts of the body. The feeling of the patient is now so far restored, that he is sensible if his skin be pinched; but he lies stupid and inattentive to slight external impressions. As the effects of concussion diminish, he becomes capable of replying to questions put to him in a loud tone of voice, especially when they refer to his chief suffering at the time, as pain in the head, &c.; otherwise, he answers incoherently, and as if his attention was occupied by something else.

As long as the stupor remains, the inflammation of the brain seems to be moderate; but as the former abates, the latter seldom fails to increase; and this constitutes the third stage, which is the most important of the series of effects proceeding from concussion.

"These several stages vary considerably in their degree and duration; but more or less of each will be found to take place in every instance where the brain has been violently shaken. Whether they bear any certain proportion to each other or not, I do not know. Indeed, this will depend upon such a variety of circumstances in the constitution, the injury, and the after-treatment, that it must be difficult to determine.

"With regard to the treatment of concussion, it would appear, that in the first stage very little can be done; and perhaps, what little is done, had better be omitted, as the brain and nerves are probably insensible to any stimulants that can be employed. From a loose, and I think, fallacious analogy between the insensibility in fainting, and that which occurs in concussion, the more powerful stimulants, such as wine, brandy, and volatile alkali, are commonly had recourse to, as soon as the patient can be got to swallow. The same reasoning which led to the employment of these remedies in the first stage, in order to recall sensibility, has given a kind of sanction to their repetition in the second, with a view to continue and increase it.

"But here the practice becomes more pernicious and less defensible. The circumstance of the brain having so far recovered its powers, as to carry on the animal functions in a degree sufficient to maintain life, is surely a strong argument that it will continue to do so, without the aid of means which probably tend to exhaust parts already weakened, by the violent action they induce.

"And it seems probable, that these stimulating liquors will aggravate that inflammation which must sooner or later ensue." (*Essay on Injuries of the Head*, p. 69.)

The following passage, extracted from a writer, who has already been of material assistance to us on this subject, cannot be too deeply impressed on the memory of every surgical practitioner.

"To distinguish between an extravasation and a commotion, by the symptoms only, is frequently a very difficult matter, sometimes an impossible one. The similarity of the effects in some cases; and the very small space of time which may intervene between the going off of the one, and accession of the other, render this a very nice exercise of the judgment. The first stunning or deprivation of sense, whether total or partial, may be from either, and no man can tell from which; but when these first symptoms have been removed, or have spontaneously disappeared; if such patient is again oppressed with drowsiness, or stupidity, or total or partial loss of sense, it then becomes most probable, that the first complaints were

from commotion, and that the latter are from extravasation; and the greater the distance of time between the two, the greater is the probability not only that an extravasation is the cause, but that the extravasation is of the limpid kind, made gradatim, and within the brain.

"Whoever seriously reflects on the nature of these two causes of evil within the cranium, and considers them as liable to frequent combination in the same subject, and at the same time considers, that in many instances no degree of information can be obtained from the only person capable of giving it (the patient,) will immediately be sensible, how very difficult a part a practitioner has to act in many of these cases, and how very unjust it must be to call that ignorance, which is only a just diffidence arising from the obscurity of the subject, and the impossibility of attaining materials to form a clear judgment.

"When there is no reason to apprehend any other injury, and commotion seems to be the sole disease, plentiful evacuation by phlebotomy and lenient cathartics, a dark room, the most perfect quietude, and a very low regimen, are the only means in our power; and are sometimes successful." (Pott.)

With these means should also be associated the constant application to the head of cloths dipped in very cold water, or Schmucker's frigorific lotion; and where the symptoms increase, or prove obstinate, blisters. Leeches are also frequently of great service.

I cannot conclude this article without advertent to the great propensity to relapse, after patients have long appeared out of every danger from wounds of the head, the bad symptoms sometimes coming on again, and proving fatal, many years after the original injury, as is exemplified in a case related in a work of high character. (See Schmucker's *Vermischte Schriften*, B. 1, p. 247.)

Hippocrates, de Capitis Vulneribus, 12mo. Lutetiae, 1578. Jac. Berengarius, de *Fractura Cranii* Bologna, 1513. James Yonge, *Wounds of the Brain* proved curable, not only by the opinion and experience of many of the best authors, but the remarkable history of a child cured of two very large depressions, with the loss of a great part of the skull; a portion of the brain also issuing through a penetrating wound of the dura and pia mater. 12mo. Lond. 1682. J. J. Wepfer, *Observationes Medico-practicae de Affectibus Capitis internis et externis*. Scaphusii, 1727. Murray, *An post gravem ab ictu vel casu capitis percussionem, non juvante etiam iterata terebratione, dura mening incisio aperienda*? Lutet. Paris. 1736. (Haller, *Disp. Chir.* 1, 97.) R. C. Wagner, *De Contrafractura*, Jena, 1708. (Haller, *Disp. Chir.* 1, 15.) J. C. Teubeler, *De Vulneribus Cerebri non semper lethaliibus*, Halle, 1760. J. Chr. Camerarius *Diss. Inaug. exhibens rarissimam sanationem Cerebri quasi cum notabili substantiae deperditione*, Tubing. 1719. Alex. Camerarius et Th. Fr. Faber *De Apostemate Pie Matris*, Tubing. 1722. J. A. Conradi, *De Vulneri fronti in-*

flicto, Lugd. 1722. M. E. Borelius et J. G. Arnoldi, *De Epilepsia ex Depresso Cranio*, Regiomont, 1724. G. A. Langguth, *Programma de Sinus Frontalis Vulnere sine terebratione curando*, Wittenb. 1748. Chopart, *Mémoire sur les lésions de la Tête par contrecoup*, 8vo. Paris, 1771. J. La Fosse, *De Cerebri Affectibus a causis externis evidenter*, Monsp. 1763. A. J. Van Hulst, *De Cerebri ejusque membranarum inflammatione et suppuratione occulta*, Ghidlenop. 1784. P. J. Primelius, *De Utilitate Incisionis integumentorum Capitis in Læsionibus Capitis*, &c. Aethre, 1780. Bordenave, in *Mem. de l'Acad. de Chirurgie*, T. 2; Le Dran, *Traité des Operations de Chirurgie*. J. L. Petit, *Traité des Mal. Chir.* T. 1. Dease, *Obs. on Wounds of the Head*. 8vo. Lond. 1776. Pott on *Injuries of the Head from External Violence*; Hill's *Cases in Surgery*; O'Halloran on the *different Disorders arising from External Injuries of the Head*, 8vo. Dublin, 1793. Some *Cases in Desault's Parisian Chirurgial Journal*; *Mémoire sur les Plaies de Tête*, in *Œuvres Chirurgicales de Desault*, par Bichat, T. 2; Lassus, *Pathologie Chirurgicale*, T. 2, p. 252, &c. Edit. 1809. Schmucker's *Wahrnehmungen*, B. 1; and *Vermischte Chir. Schriften*, B. 1 and 3, 8vo. Berlin, 1785. Richerand, *Nosographie Chir.* T. 2, p. 230 et seq. Edit. 4. J. Abernethy on *Injuries of the Head*, in his *Surgical Works*, Vol. 2. Ed. 1811; Larrey, in *Mem. de Chir. Militaire*, T. 2, 3, et 4, 8vo. Paris, 1812—1817; Dr. Hennen, *Principles of Military Surgery*, Ed. 2, 8vo. Edinb. 1820. The three last works, and those of Le Dran, Petit, Desault, and Bichat. Dease, O'Halloran, Pott, and Schmucker, deserve particular attention. Also Dr. J. Thomson's *Report of Observations made in the military hospitals in Belgium*; Edinb. 1816.

HEMERALOPIA. According to M. Dujardin, this term is derived from *ἡμέρα*, the day, *ἄρα*, blind, and *ὄφθαλμος*, the eye, and its right signification is therefore inferred to be diurna cæcitas, or day-blindness. (See *Journal de Med.* T. 19, p. 348.) In the same sense, Dr. Hillary (*Obs. on the Diseases of Barbadoes*, p. 298, Edit. 2.) and Dr. Heberden (*Med. Trans.* Vol. 1, Art. 5.) have employed the term.

Hemeralopia then, which is of very rare occurrence, stands in opposition to the nyctalopia of the ancients, or night-blindness. Numerous modern writers, however, have used these terms in the contrary sense; considering the hemeralopia, as denoting sight during the day, and blindness in the night; and nyctalopia, as expressing night-seeing, owl-sight, as the French call it, and blindness during the day-time.

Hemeralopia, in the meaning of day-blindness, is a very uncommon affection. Dr. Hillary never met with but two examples. He mentions a report, however, that there are a people in Siam, in the East Indies, and also in Africa, who are subject to the disease of being blind in the day, and seeing well by night. (*Mod. Univ. Hist.* Vol. 7.)

According to Sauvages, hemeralopia, (in

this nomenclature called *amblyopia crepuscularis*,) was in some degree epidemic in the neighbourhood of Montpellier, in the villages, in damp situations adjoining rivers, and it particularly affected the soldiers, who slept in the open damp air. They were cured, he says, by blistering, together with emetics and cathartics, and other evacuations. (*Nosol. Method. Class 6, Gen. 3, Spec. 1.*)

See some ingenious observations on the subject in *Dr. Rees's Cyclopædia, Art. Hemeralopia*, and by Mr. Bampfield in *Med. Chir. Trans. Vol. 5, p. 34, &c.*

Scarpa, with the generality of modern writers, has considered hemeralopia as an affection, in which the patient sees very well in the day, but not in the nighttime.

The abolition of eyesight by night (observes Mr. Bampfield,) has occurred in all ages, and is a common disease of seamen in the East and West Indies, Mediterranean, and in all hot and tropical countries and latitudes, and affects more or less the natives likewise of those regions of the globe. It also occurs frequently among soldiers in the East and West Indies; but he has been informed, that it is by no means so prevalent among them as sailors. It is not an uncommon complaint of the Lascars, employed in the East-India Company's ships, trading between India and Europe. It has very rarely indeed affected the officers of his Majesty's, or of the East-India Company's ships. Celsus has remarked, that women and virgins, whose menstrual returns are regular, are exempt from this disease (*lib. 6, cap. 6.*) and it may be observed, that the inhabitants of cold latitudes are less subject to hemeralopia in their own climate, than the natives of tropical countries are in theirs; but more so, when they visit the tropics. (*Med. Chir. Trans. Vol. 5, p. 38.*)

"*Hemeralopia*, or *nocturnal blindness* (says Scarpa,) is properly nothing but a kind of imperfect periodical amaurosis, most commonly sympathetic with the stomach. Its paroxysms come on towards the evening, and disappear in the morning. The disease is endemic in some countries, and epidemic, at certain seasons of the year, in others.

"At sunset, objects appear to persons affected with the complaint, as if covered with an ash-coloured veil, which gradually changes into a dense cloud, which intervenes between the eyes, and surrounding objects. Patients with hemeralopia have the pupil, both in the day and night-time, more dilated, and less moveable, than it usually is in healthy eyes. The majority of them, however, have the pupil more or less moveable in the daytime, and always expanded and motionless at night. When brought into a room faintly lighted by a candle, where all the by-standers can see tolerably well, they cannot discern at all, or in a very feeble manner, scarcely any one object; or they only find themselves able to distinguish light from darkness; and at moonlight their sight is still worse. At daybreak they recover their sight, which continues perfect

all the rest of the day, till sunset." (*Cap. 19, p. 322, Edit. 8vo.*)

According to Mr. Bampfield, the disease always affects both eyes at the same time. "In general, (says this gentleman) the nocturnal blindness is at first partial, the patient is enabled to see objects a short time after sunset, and perhaps will be able to see a little by clear moonlight. At this period of the complaint, he is capable of seeing distinctly by bright candlelight. The nocturnal sight, however, becomes daily more impaired and imperfect, and, after a few days, the patient is unable to discriminate the largest objects after sunset, or by moonlight, &c. and finally, after a longer lapse of time, he cannot perceive any object distinctly by the brightest candlelight. If the patient is permitted to remain in this state of disease, the sight will become weak by daylight, the rays of the sun will be too powerful to be endured, whether they are direct, or reflected; lippitude is sometimes induced; myopism, or shortness of sight, succeeds; and, in progress of time, vision becomes so impaired and imperfect, that apprehensions of a total loss of sight are entertained; and this dreadful consequence has been known to ensue, where the complaint has been totally neglected, or left to nature, or where ineffectual remedies have been employed." (*Bontius, p. 73.*)

"It has been remarked by some, that the patients are capable of seeing distinctly, at all periods of the complaint, with the aid of a strong artificial light; but, in bad cases of hemeralopia, in my practice, the patients positively denied the existence of the sense of distinct sight by very clear candlelight. (*Bampfield in Medico-Chir. Trans. Vol. 5, p. 39, 40.*)

The duration of the disease, when left to itself, is generally from two weeks to three, or six months. Experience has not proved, that the disposition to the complaint depends upon any particular colour of the iris, as several writers have conjectured; nor upon the largeness of the eyes, as alleged by Hippocrates. (*Lib. 6, sec. 7.*)

In idiopathic cases, the health does not in general suffer, and except in the worst stage, the eye is not altered in appearance. But in cases of long duration, the pupil, according to Mr. Bampfield, "is often contracted, and the eyes and actions of the patient evince marks of painful irritation, if the eyes are exposed to a vivid light; or if he looks upward. But, if they meet the direct rays of the sun, which in the tropics are always powerful, or a strong glaring reflection of them, pain and temporary blindness are induced, from which the patient recovers, by closing his eyelids for a time to exclude the rays of light, and retiring to the shade. The pupil of the eye is considerably dilated, both by day and night, in the proportion of about one case in twelve, and at night the pupil is often dilated, and does not perform its expansions and contractions, when exposed to the moon, or artificial light. The cases, at

tended with dilated pupil, were generally those of long duration, &c.

"Europeans, who have been once affected with hemeralopia, in tropical climates, are particularly liable to a recurrence of this disease, as long as they remain in them." (*Bamfield, op. cit. p. 42, 43.*)

The remote causes of idiopathic hemeralopia are not well ascertained. Bontius imputes the complaint to eating hot rice. (*P. 72, 73.*) Sleeping with the face exposed to the brilliancy of daylight, the vivid reflection of the sun's rays from the sandy shores of hot countries, and bright moonlight, have been enumerated as causes. Dr. Pye thinks the disorder intermittent. (*Med. Obs. and Inquiries, Vol. 1, art. 13.*) But, as Mr. Bamfield properly observes, though the complaint is certainly periodical, there is nothing in its character tending to prove, that it is influenced by the same causes as intermittent fever. The latter gentleman conjectures, "that too much light suddenly transmitted to the retina, or for a long period acting on it, may afterward render it unsusceptible of being stimulated to action, by the weaker or smaller quantities of light, transmitted to it by night." (*P. 44*) Among other objections to this explanation, however, it might be remarked, that the patients do not always see, though the light be good; and Mr. Bamfield's own "patients positively denied the existence of distinct sight by very clear candlelight." Besides, if the disease were entirely caused by the sudden, or long operation of vivid light, one would conclude, that all persons subjected to that cause, ought to have the effect produced, which is far from being the case.

When the tongue is white, and the patient has headache and bilious complaints, M. Lassus thinks the cause of the disease is in the stomach and primæ viæ. The same author likewise states, that hemeralopia attacks debilitated persons, subject to catarrhal affections, residing in damp situations, and living on indigestible food. From the combination of such causes, (says he) the disorder was epidemic in the vicinity of Montpellier, (*Sauvage, Nosolog. Method. T. 2, p. 732*;) at Belle-Isle sur Mer, (*Recueil d'Observ. de Médecine des Hôpitaux militaires, par Richard, T. 2, p. 573*;) and hence it is endemic in watery situations, where the nights are cold and damp. They who expose themselves to this humidity, (says M. Lassus,) or who navigate along the eastern coasts of Africa, who traverse the Mozambic canal, or sail along the coasts of Malabar and Coromandel, are sometimes attacked by it. (See *Pathologie Chirurgicale, Tom. 2, p. 542, 543.*) Hemeralopia sometimes occurs as a symptom of the scurvy. This fact was noticed by Mr. Telford, in Sir G. Blane's Treatise on Diseases of Seamen, and it is likewise confirmed by Mr. Bamfield, who remarks, that hemeralopia should be referred to the same causes as scurvy, "when the subject of it has for a long period subsisted on a salted diet at sea, &c. and if any other scorbutic symptom be present, such as spongy gums,

ecchymoses, saline smell of the secretions, ulcers with liver-like fungus, &c. (*Medico-Chir. Trans. Vol. 5, p. 45.*)

This disease (according to Scarpa) may commonly be completely cured, and oftentimes in a very short time, by treating it on the same plan by which the imperfect amaurosis is remedied; (see *Amaurosis*;) viz. by employing emetics, the resolvent powders, and pills, and a blister on the nape of the neck; and topically, the vapours of the caustic volatile alkali: lastly, by prescribing, towards the end of the treatment, bark conjoined with valerian. In cases in which the disease has been preceded by plethora, and suppressed perspiration, bleeding and sudorifics are also indicated. (*Cap. 19, p. 322—333.*)

Scarpa supports this statement by the relation of three cases, in which he cured the disease by such treatment. These patients were all unhealthy, and evidently labouring under disorder of the gastric organs.

One hundred cases, however, of idiopathic, and two hundred of symptomatic hemeralopia, occurred in the practice of Mr. Bamfield, in different parts of the globe, but chiefly in the East Indies. All these cases perfectly recovered: and hence, we may infer, that under proper treatment, a favourable prognosis may always be given.

Scarpa notices, that the ancients have strongly recommended, for the cure of this disease, the fumigations of a sheep's liver fried. These were directed against the eyes through a funnel; and the liver thus prepared, was also directed to be eaten. Even in Italy, according to Scarpa, this remedy in general obtains confidence, not only with the vulgar, but also with surgeons. Some writers add, that it is productive of wonderful success among the Chinese, who are said to be very liable to this complaint. Scarpa says he has no observation of his own to offer in support of this account; but the plan was tried without success in a boy, whom Scarpa cured by emetic and aperient medicines, and the ammoniacal vapours.

Celsus has stated that persons who have been for some time affected with amaurosis, have regained their sight on being attacked by a diarrhœa. This seems to Scarpa to be corroborated by the case related by Doctor Pye. (*Med. Obs. and Inq. Vol. 1.*) A man, forty years of age, says he, had been affected for two months with periodical amaurosis, which, for a certain time, had occurred regularly every evening, but afterward came on irregularly, at different intervals, with considerable dilatation of the pupil, and such obscuration of sight on the approach of night, that even the light of a candle could not be discerned. The man was seized with a diarrhœa. Doctor Pye ordered him to take, for eight successive days, a potion with the kali præparatum; then he prescribed an electuary, composed of bark, nutmeg, and syrup of orange peel. The two latter ingredients were added to the bark, on account of the continuance of the diarrhœa.

The second day after the electuary had been taken, the diarrhœa increased, and the patient vomited copiously; after which he suddenly recovered his sight, so as to see equally well by day and by night. As the diarrhœa continued, the electuary was omitted, after having been taken two days. A violent fever succeeded the diarrhœa, and it was remarked, that during the highest stage of the former, the patient became rather deaf, but without losing his sight in the night or daytime. Dr. Pye does not mention what steps were taken to moderate the fever, which proved fatal to the patient. At all events, adds Scarpa, it is a fact, that this spontaneous laxness of the bowels entirely freed the man from an imperfect periodical amaurosis. Scarpa entertains no doubt, that by looking attentively into the numerous collections of medical observations, one might find in them a great many facts similar to the preceding one, showing the influence of what he terms morbid gastric stimuli over the organ of sight, and consequently, the great utility of a spontaneous looseness of the bowels in the cure of the imperfect amaurosis.

But, says Scarpa, even if such examples of the incomplete amaurosis being dissipated in consequence of spontaneous vomiting, or copious evacuations from the bowels, produced entirely by nature, were rare and noticed by few, we now have so many observations, evincing the successful cure of this disease by means of such evacuations, artificially produced by emetics, and purgative medicines, that no doubt whatever can be entertained concerning the accuracy of the second part of Celsus's admonition relative to the present view of the imperfect amaurosis: *et recenti re, et interposito tempore, medicamentis quoque moliri dejectiones, quæ omnem noxiam materiam per inferiora depellant*. Of this Scarpa remarks, we undoubtedly have numerous satisfactory proofs, in the accurate observations related by Schmucker and Richter; but our confidence, says Scarpa, in the above method of curing the imperfect and periodical amaurosis must increase, when we take notice that the most respectable practitioners of past times have, in the majority of cases, cured this disease only by means of emetics, and opening medicines, though, in their writings, they may have imputed the success of the treatment to other causes, or the efficacy of other remedies, which were also prescribed.

Scarpa, after several valuable remarks on amaurosis in general, refers to the *Mercur de France*, for February, 1756, where there is an account of the cures performed by Fournier on several subjects affected with hemeralopia. The first were three soldiers, to whom an emetic was administered after bleeding them. The next day, as they also complained of a heaviness in their heads, and nausea, the bleeding and emetic were repeated. This expedient removed all the above symptoms, and these three soldiers were no longer unable to see in the night-

time. Fournier met with equal success in treating eight other soldiers upon the same plan, who were affected with the same disease, and belonged to the same garrison.

Night-blindness is sometimes congenital, and therefore constitutional, and altogether beyond the reach of any curative measure. It is said sometimes to be hereditary, and the writer of the article *Nyctalopia*, in Dr. Rees's *Cyclopædia*, was acquainted with an instance in which it occurred to two children of the same family. A case of congenital nyctalopia, which had continued many years without change, and independently of any disease, is related by Dr. Parham. (See *Med. Obs. and Inquiries, Vol. I. p. 122, note.*)

Scarpa notices that Pellier (*Recueil de Mem. et Obs. sur l'Œil. Obs. 132.*) cured captain Micetti of an hemeralopia by repeated doses of tartar-emetic, a seton in the nape of the neck, and cooling aperient beverages. Pellier also assures us, that he has several times cured the recent imperfect amaurosis, by means of small doses of tartar-emetic, and topical aromatic fumigations. (*Observ. 136—138.*)

The method of treatment which Mr. Bampfield adopted, is certainly quite simple. "A succession of blisters to the temples, (says he) of the size of a crown or half-crown piece, applied tolerably close to the external canthus of the eye, has succeeded in every case of idiopathic hemeralopia, which I have seen, &c. The first application of blisters commonly enables the patient to see dimly by candlelight, or perceive objects without the power of discriminating what they are. In some slight cases, that admitted of easy cure, the first application has succeeded perfectly. The second application of blisters commonly enables the patient to see by candlelight distinctly, perhaps by bright moonlight, and even half an hour after sunset, or the sight is restored for short periods during the night, and is again abolished. The second application very often effects a perfect recovery. The third, fourth, or fifth applications, in succession, generally produce a complete recovery, where the first or second have failed; but some rare instances of very obstinate hemeralopia have required even ten successive blisters to each temple; or instead of using them in succession, a perpetual vesicatory has been formed on each temple, and maintained, until a cure has been accomplished, an event which has generally followed in a fortnight." (*Bampfield in. Medico-Chir. Trans. Vol. 6, p. 47, 48.*) In some cases, shades over the eyes were worn during the treatment, and a certain time after the cure. The patients were also often directed to bathe their eyes with cold water two or three times a day.

Mr. Bampfield also knew of instances in which electricity was successfully employed as a topical stimulus to the eye. He also informs us, that a spontaneous cure sometimes followed the eruption of boils on the

head or face, or the formation of abscesses on these parts, or in the ears.

Although the blisters will generally effect a cure, there were particular cases in which Mr. Bampfield administered cathartics, such as calomel and the neutral salts. In these examples the patient had bilious complaints, indicated by a yellow state of the tongue and skin, headach, and pain about the præcordia; or symptoms of indigestion, white tongue, loss of appetite, pain and flatulence of the stomach, &c.

In the scorbutic hemeralopia, the application of blisters is to be deferred until the state of the constitution is amended, by giving lemon and lime-juice, and fresh animal and vegetable food; because the hemeralopia often gradually ceases as the scurvy is cured; and before this last event, the blister might produce a scorbutic ulcer. Mr. Bampfield estimates, that about one-third of the cases of scorbutic hemeralopia resist the efficacy of the antiscorbutic regimen and medicines; and consequently, must ultimately be treated as idiopathic cases.

The frequent recurrence of this disease, during the patient's continuance in a tropical or hot climate, naturally suggests the propriety of recommending him to return to his native climate, by which change the tendency to a relapse is in general completely removed. (Bampfield, in *Medico-Chir. Trans. Vol. 5, p. 53*.)

Consult *Celsus de re Medica, Cap. 6, lib. 6. Galeni Op. Lib. de Oculis pars 4, cap. 11. 22. Ætii Sermo Septimus, cap. 48, 52, 46. Paul. Æginæ Lib. 3, cap. 48. Actuarius. De Method. med. lib. 4, cap. 11. Rhasis, De Ægritudine Ocul. cap. 4. Avicenna, Lib. 3, fen. 3, tractat. 4. Fabricii Hildani Centur. 1, Obs. 24; centur. 5, obs. 13. Platner, Praxis, Med. C. A. Bergen et J. C. Weise, De Nyctalopia seu Cæcitate Nocturna; Haller, Disp. ad Morb. &c. 359. Journal de Médecine et de Chirurgie ann. 1756, T. 4. Medical Observations and Inquiries, Vol. 1. Recueil d'Observations de Médecine des hôpitaux militaires, par Richard, T. 2. Dupont, Mémoire sur la Goutte Sereine Nocturne épidémique, ou Nyctalopie. Observations on Tropical Nyctalopia, by Mr. J. Forbes, in *Edinb. Medical and Surgical Journal*, No. 28, p. 417 et seq. Richter's *Anfangsgrunde der Wundarzneykunst*, B. 3, p. 483 et seq. Schmucker's *Chirurgische Schriften*, Band. 2. Saggio di Osservazioni e d'Esperienze Sulle Principali Malattie degli Occhi di Antonio Scarpa, p. 322 et seq. Edit. Svo. Venezia, 1802. Lassus, *Pathologie Chirurgicale*, T. 2, p. 539, Edit. 2. Rees's *Cyclopædia*, art. *Nyctalopia*. A Practical Essay on Hemeralopia, or Night-blindness, commonly called Nyctalopia, by R. W. Bampfield, in *Medico-Chir. Trans. Vol. 5, p. 32 et seq. A Simpson on Hemeralopia*, Svo. Glasgow, 1819. C. H. Weller, *A Manual of the Diseases of the Eye*, transl. by Dr. Monteath; Vol. 2, p. 142, Svo. Glasgow. 1821.*

HEMIOPIA. (from *ἡμιος*, half, and *ὤψ*, the eye. A certain disorder of the eye, in which the patient cannot see the whole of any object which he is looking at, but only

a part of it. Sometimes he sees the middle, but not the circumference, sometimes the circumference, but not the centre; while on other occasions, it is only the upper, or lower half, which is discerned. Sometimes objects are seen thus imperfectly, whether distant or near; sometimes, only when they are near, and not at a great distance.

The causes of hemiopia are divided by Richter into four kinds.

To the first belong opacities of the cornea and crystalline lens, especially such as destroy the transparency of only a certain portion of these parts.

The cure of this species of hemiopia depends upon the removal of the partial opacity from which it originates. (See *Cataract and Cornea, Opacities of*.)

Under certain circumstances, persons, whose upper eyelid cannot be properly raised, are affected with hemiopia. They can only discern the lower half of an object, which is near and of large size, unless they go farther from it, draw their heads backward, or turn their eyes downward. The pupil, in particular instances, becomes drawn away from the middle of the iris. This may also be a cause of hemiopia: it is a case that does not admit of a cure. The affection may likewise proceed from a separation of the iris from the margin of the cornea by external violence, or other causes. Here the cure is equally impracticable.

The foregoing species of hemiopia are merely effects of other diseases. The fourth and last kind is the most important, being generally regarded as an independent disorder. Sometimes it appears rather to be the effect of a sudden and transient irritation, producing a morbid sensibility in the optic nerve.

The causes of this sort of case, if we can credit Richter, are mostly seated in the abdominal viscera. When the affection is more durable, forming what has been termed *amaurosis dimidiata*, the same treatment is indicated as in *Amaurosis*, in which indeed, it often terminates. (Richter *Anfangsgr. der Wundarz. B. 3, Kap. 17*.)

HEMORRHAGE. (from *αἷμα*, blood, and *ῥέω*, to break out.) *Bleeding.*

This is doubtless one of the most important subjects in Surgery. The fear of hemorrhage retarded the improvement of our profession for ages: the ancients, ignorant how to stop bleeding, were afraid to cut out the most trivial tumour, or they did so with terror. They generally performed slowly and imperfectly, by means of burning irons, or ligatures, the same operations which the moderns execute quickly and safely with a knife. If the old surgeons ventured to amputate a limb, they only did so after it had mortified, by dividing the dead parts, and so great was their apprehension of hemorrhage, that they only dared to cut parts which could no longer bleed. (John Bell's *Principles of Surgery*, Vol. 1, p. 142.) But not only as a consequence of surgery, is hemorrhage to be feared; it is also one of the most alarming accidents, which surgery is called upon to

relieve. "Un sentiment naturel attache à l'idée de perdre son sang; un terreur machinale, dont l'enfant, qui commence à parler, et l'homme le plus décidé, sont également susceptibles. On ne peut point dire, que cette peur soit chimérique. Si l'on comptoit ceux, qui perdent la vie dans une bataille, on verroit, que les trois quarts ont péri par quelque hemorrhagie; et dans les grandes opérations de chirurgie cet accident est presque toujours le plus formidable." (Morand. Mem. de l'Acad. Royale de Chirurgie, Vol. 5. 8vo.)

As the blood circulates in the arteries with much greater impetus and rapidity, than in the veins, it necessarily follows, that their wounds are generally attended with much more hemorrhage, than those of the latter vessels, and that such hemorrhage is more difficult to suppress. However, as the blood also flows through veins of great magnitude, with great velocity, bleedings from them are frequently highly dangerous, and sometimes unavoidably fatal. When an artery is wounded, the blood is of a bright scarlet colour, and gushes from the vessel *per saltum*, in a very rapid manner. The blood issues from a vein in an even unbroken stream, and is of a dark purple red colour. It is of great practical use to remember these distinguishing differences between arterial and venous hemorrhage, because, though in both cases the oozing of blood may be equal in quantity, yet in the latter instance, the surgeon is often justified in bringing the sides of a wound together, without taking farther means to suppress the bleeding, while it would not be proper to adopt the same conduct, were there an equal discharge of arterial blood.

Dr. Jones has favoured the world with a matchless work, on the present subject; and as one grand object of this Dictionary is to present a careful account of the principal modern improvements in surgical science, I shall first endeavour to make the reader acquainted with the more accurate doctrines first promulgated by this gentleman relative to the subject of hemorrhage. Afterward, the surgical means to be practised in different cases, will be considered.

The sides of the arteries are divisible into three coats. The *internal one* is extremely thin and smooth. It is elastic and firm, (considering its delicate structure) in the longitudinal direction, but so weak in the circular as to be very easily torn by the slightest force applied in that direction. Its diseases show, that it is vascular, and it is also probably sensible.

The *middle coat* is the thickest, and is composed of muscular fibres, all arranged in a circular manner; they differ, however, from common muscular fibres in being more elastic, by which they alone keep a dead artery open, and of a cylindrical form. As this middle coat has no longitudinal fibres, the circular fibres are held together by a slender connexion, which yields readily to any force applied in the circumference of the artery.

The *external coat* is remarkable for its whiteness, density, and great elasticity. When an artery is surrounded with a tight

ligature, its middle and internal coats are completely divided by it, as they could be by a knife, while the external coat remains entire.

Besides these proper coats, all the arteries, in their natural situations, are connected by means of fine cellular substance, with surrounding membranous sheaths. If an artery be divided, the divided parts, owing to their elasticity, recede from each other, and the length of the cellular substances, connecting the artery with the sheath, admits of its retracting a certain way within the sheath.

Another important fact is: that when an artery is divided, its truncated extremities contract in a greater or less degree, and the contraction is generally, if not always, permanent.

Arteries are furnished with arteries, veins, absorbents, and nerves; a structure, which makes them susceptible of every change to which living parts are subjected in common; enables them to inflame when injured, and to pour out coagulating lymph, by which the injury is repaired, or the tube permanently closed. (See Jones on Hemorrhage.)

Petit the surgeon, in 1731, first endeavoured to explain the means which nature employs for the suppression of hemorrhage. He thought, that bleeding from a divided artery is stopped by the formation of a coagulum of blood, which is situated partly *within*, and partly *without* the vessel. The clot, he says, afterward adheres to the inside of the artery, to its orifice, and to the surrounding parts; and he adds, that when hemorrhage is stopped by a ligature, a coagulum is formed above the ligature, which only differs in shape from the one which takes place when no ligature is employed. His opinion leads him to recommend compression for the support of the coagulum.

In 1736, Morand published additional interesting remarks. He allowed, that a coagulum had some effect in stopping hemorrhage; but contended, that a corrugation, or plaiting of the circular fibres of the artery which diminish its canal, and a shortening and consequent thickening of its longitudinal ones, which nearly rendered it impervious, had some share in the process. He thought that the cavity of an artery might be obliterated by the puckering, or corrugation, when circular pressure, like that of a ligature, is made.

Morand erred chiefly in his mode of explanation, and in his belief in the existence of longitudinal fibres, which no modern anatomists admit; for the contraction, and retraction of divided arteries, are indisputable facts, and, as Dr. Jones remarks, this does not affect the truth of his general conclusion, that the change produced on a divided artery, contributes with the coagulum to stop the flow of blood.

Mr. S. Sharp (2d Edit. of *Operations of Surgery*, 1739,) supported the same doctrine. "The blood-vessels, immediately upon their division, bleed freely and continue bleeding, till they are either stopped by art, or at length contracting and withdrawing themselves into the wound, their extremities are shut up by coagulated blood."

Pouteau (*Mélanges de Chirurgie*, 1760,) denied that a coagulum is always found after an artery is divided: and when it is, he thought it only a feeble and subsidiary means towards the suppression of hemorrhage. He contended, that the retraction of the artery had not been demonstrated, and could not be more effectual than a coagulum. His theory was, that the swelling of the cellular membrane, at the circumference of the cut extremity of the artery, forms the principal impediment to the flow of blood; and that a ligature is useful in promoting a more immediate and extensive induration of the cellular substance.

Gooch, White, Aikin, and Kirkland. all oppose Petit's doctrine of coagulum. The first, blends some of Pouteau's theory with his own, by observing that "when a small artery is totally divided, its retraction may bring it under the surrounding parts, and with the natural contraction of the diameter of its mouth, assisted by the compressive power of those parts, increased by their growing tumid, the efflux of blood may be stopped."

White was convinced, from what Gooch had suggested, and Kirkland confirmed, that the arteries, by their natural contraction, coalesce, as far as their first ramification.

Dr. Jones admits, that an artery contracts after it has been divided, and his experiments authorize him to say, that the contraction of an artery is an important means, but certainly not the only, nor even the chief means by which hemorrhage is stopped. When the artery is above a certain size, the impetuous flow of blood through the wound of the artery would resist the contraction of the vessel in such a degree, that the consequences would be fatal in almost every instance, were it not for the formation of a coagulum. (*Jones*.)

Mr. J. Bell thinks, that when hemorrhage stops of its own accord, it is neither from the retraction of an artery, nor the constriction of its fibres, nor the formation of clots, but by the cellular substance, which surrounds the artery, being injected with blood.

We must refer the reader to Dr Jones's work for a complete exposure of the inconsistencies and absurdities in Mr. Bell's account of his own theory. (See *P. 25. &c*.)

Dr. Jones concludes his criticisms on Mr. Bell with observing, that if this gentleman really means to confine his doctrine of the natural means of suppressing hemorrhage to the injection of the cellular substance round the artery, with blood, he dwells improperly on one of the attendant circumstances to the exclusion of the retraction, and contraction of an artery, and the formation of a distinct clot, all primary parts of the process.

The blood, besides filling the cellular substance round the artery, also fills the cellular substance at the mouth of the artery in a particular manner; for the divided vessel, by its retraction within its cellular sheath, leaves a space of a determinate form, which, when all the circumstances necessary for the suppression of hemorrhage operate, is gradually filled up by a distinct clot. (*Jones*.)

MEANS OF NATURE IN STOPPING BLEEDING FROM DIVIDED ARTERIES.

Dr. Jones has given a faithful and accurate detail of a series of experiments on animals, which demonstrate "that the blood, the action, and even the structure of the arteries, their sheath, and the cellular substance, connecting them with it," are concerned in stopping bleeding from a divided artery of moderate size, in the following manner: "An impetuous flow of blood a sudden and forcible retraction of the artery within its sheath, and a slight contraction of its extremity, are the immediate, and almost simultaneous effects of its division. The natural impulse, however, with which the blood is driven on, in some measure counteracts the retraction, and resists the contraction of the artery. The blood is effused into the cellular substance, between the artery and its sheath, and passing through that canal of the sheath, which had been formed by the retraction of the artery, flows freely externally, or is extravasated into the surrounding cellular membrane, in proportion to the open, or confined state of the wound. The retracting artery leaves the internal surface of the sheath uneven, by lacerating, or stretching the cellular fibres, that connected them. These fibres entangle the blood as it flows, and thus the foundation is laid for the formation of a coagulum at the mouth of the artery, and which appears to be completed by the blood, as it passes through this canal of the sheath, gradually adhering and coagulating around its internal surface, till it completely fills it up from the circumference to the centre." (*Jones p. 53.*)

The effusion of blood into the surrounding cellular membrane, and between the artery and its sheath; but in particular, the diminished force of the circulation from loss of blood, and the speedy coagulation of this fluid under these circumstances, most essentially contribute, says Dr. Jones, to the desirable effect.

It appears then, that a coagulum, which Dr. Jones calls the *external* one, situated at the mouth of the artery, and within its sheath, forms the first complete obstacle to the continuance of bleeding, and though it seems externally like a continuation of the artery, yet, on slitting open this vessel, its termination can be plainly observed, with the coagulum shutting up its mouth, and contained in its sheath.

No collateral branch being very near the impervious mouth of the artery, the blood just within it is at rest, and usually forms a slender conical coagulum, which neither fills up the canal of the artery, nor adheres to its sides, except by a small portion of the circumference of its base, near the extremity of the vessel. This coagulum is distinct from the former, and what Dr. Jones calls the *internal* one.

The cut end of the artery next inflames, and the vasa vasorum pour out lymph, which fills up the extremity of the artery, is situated between the internal and external co-

agula, and is somewhat intermingled with them, or adheres to them, and is firmly united all round to the internal coat of the vessel. Dr. Jones further states, that the permanent suppression of hemorrhage chiefly depends on this coagulum of lymph; but that the end of the artery is also secured by a gradual contraction which it undergoes, and by an effusion of lymph between its tunics, and into the surrounding cellular substance; whereby these parts become thickened, and so incorporated with each other, that one cannot be discerned from the other. Should the wound in the integuments not heal by the first intention, the coagulating lymph, soon effused, attaches the artery firmly to the subjacent and lateral parts, gives it a new covering, and entirely excludes it from the outward wound.

The same circumstances are also remarkable in the portion of the vessel, most remote from the heart. Its orifice, however, is usually more contracted, and its external coagulum smaller than the one which attaches itself to the other cut end of the artery. (*Jones on Hemorrhage, p. 56.*)

The impervious extremity of the artery, no longer allowing blood to circulate through it, the portion which lies between it and the first lateral branch gradually contracts, till its cavity is completely obliterated, and its tunics assume a ligamentous appearance. In a few days the external coagulum, which in the first instance stopped the hemorrhage, is absorbed, and the coagulating lymph, effused around it, and by which the parts were thickened, is gradually removed, so that they resume again their cellular texture.

At a still later period, the ligamentous portion is reduced to a filamentous state, so that the artery is, as it were, completely annihilated from its cut end to the first lateral branch; but long before this final change is accomplished, the insulating branches have become considerably enlarged, so as to establish a free communication between the disunited parts of the main artery.

When an artery has been divided at some distance from a lateral branch, three coagula are formed: one of blood externally, which shuts up its mouth; one of lymph, just within the extremity of its canal; and one of blood within its cavity, and contiguous to that of lymph. But, when the artery has been divided near a lateral branch, no internal coagulum of blood is formed. (*Jones, p. 63.*)

The external coagulum is always formed when the divided artery is left to nature; not so, however, if art interferes, for under the application of the ligature it can never form. If agaric, lycoperdon, or sponge, be used, its formation is doubtful, depending entirely upon the degree of pressure that is used; but the internal coagulum of blood will be equally formed, whether the treatment be left to art, or nature, if no collateral branch is near the truncated extremity of the artery; and lastly, effused lymph, which, when in sufficient quantity, forms a distinct coagulum, just at the mouth of the artery,

will be always found, if the hemorrhage is permanently suppressed. (*Jones, p. 74.*)

MEANS WHICH NATURE EMPLOYS FOR SUPPRESSING THE HEMORRHAGE FROM PUNCTURED, OR PARTIALLY DIVIDED ARTERIES.

The suppression of hemorrhage by the natural means is sometimes more easily accomplished, when an artery is completely divided, than when merely punctured, or partially divided. Completely dividing a wounded artery was one means practised by the ancients for the stoppage of hemorrhage: the moderns frequently do the same thing, when bleeding from the temporal artery proves troublesome.

Dr. Jones has related many experiments, highly worthy of perusal, and which were undertaken to investigate the present part of the subject of hemorrhage. This gentleman, however, owns, that in regard to the temporary means, by which the bleeding from a punctured artery is stopped, he has but little to add to what Petit has explained, in his third publication on hemorrhage. (*Mém. de l'Acad. des Sciences; 1735.*) The blood is effused into the cellular substance, between the artery and its sheath, for some distance, both above and below the wounded part; and when the parts are examined, a short time after the hemorrhage has completely stopped, we find a stratum of coagulated blood between the artery and its sheath, extending from a few inches below the wounded part to two, or three inches above it, and somewhat thicker, or more prominent over the wounded part, than elsewhere.

Hence, rather than say the hemorrhage is stopped by a coagulum, it is more correct to say, that it is stopped by a thick lamina of coagulated blood, which, though somewhat thicker at the wounded part, is perfectly continuous with the coagulated blood lying between the artery and its sheath. (*Jones, p. 113.*)

When an artery is punctured, the hemorrhage immediately following, by filling up the space between the artery and its sheath, with blood, and consequently distending the sheath, alters the relative situation of the puncture in the sheath to that in the artery, so that they are not exactly opposite to each other; and by this means a layer of blood is confined by the sheath over the puncture in the artery, and by coagulating there, prevents any further effusion of blood.

But this coagulated blood, like the external coagulum of a divided artery, affords only a temporary barrier to the hemorrhage: its permanent suppression is effected by a process of reparation, or of obliteration.

Dr. Jones's experiments prove, that an artery, if wounded only to a moderate extent, is capable of reuniting and healing so completely, that after a certain time the cicatrization cannot be discovered, either on its internal, or external surface; and that even oblique and transverse wounds (which gape most) when they do not open the artery to

to a greater extent than one-fourth of its circumference, are also filled up and healed by an effusion of coagulating lymph from their inflamed lips, so as to occasion but little, or no obstruction to the canal of the artery. The utmost magnitude of a wound, which will still allow the continuity of the canal to be preserved, is difficult to be learnt; for when the wound is large, but yet capable of being united, such a quantity of coagulating lymph is poured out, that the canal of the vessel, at the wounded part, is more or less filled up by it. And when the wound is still larger, the vessel soon becomes either torn, or ulcerated completely across, by which its complete division is accomplished.

Beclard made a series of experiments upon dogs, whose arteries are said not to differ much from those of man, though *the impulse of the heart is not so strong, and the blood is more coagulable*; two circumstances which should be duly considered, in applying any of the inferences drawn from such experiments to the human subject. "In his first experiment, he pricked the femoral artery with a needle; the blood flowed; but soon stopped. On removing the coagulum it again flowed, but in a small stream; it gradually ceased to bleed, and finally stopped, though the coagulum was again scraped off. On examination of the artery no trace of the cicatrix was found. Several similar experiments had the same result. In experiment 4, he denuded the femoral artery, and made a longitudinal cut in it, from two to three lines. The lips of the wound were seen in contact during the diastole of the ventricle, and to be separated by a jet of blood during the systole. The blood was stopped by a coagulum; this was removed twice, and each time the blood flowed in a diminished stream, but the animal died. In experiment 6, he made the same incision, but did not detach the sheath from the artery, and the wound was left to nature. The hemorrhage was not great; there was an infiltration of blood into the sheath the size of an almond, which at the end of some days began to diminish, and disappeared in two or three weeks. On the limb being examined fifteen days afterward, a little white ridge was found adhering firmly to the artery, and to the sheath, and completely closing the wound. In the interior, there was a depressed longitudinal cicatrix of the breadth of the fifth of a line. *The canal was regular and pervious through its whole extent.*

"In experiments 7, 8, 9, he made transverse incisions of 1-4, 1-2, and 3-4 of the circumference of the femoral artery, *separated from its sheath*: all the animals died. In experiment 10, he made a transverse incision through 1-4 of the circumference, *without disturbing the sheath*. The bleeding was stopped by a coagulum, but on the animal moving, it again flowed, and the dog died. But in the next experiment of the same kind, the blood was stopped by a coagulum, and the artery was closed by nearly the same process as in the 6th experiment. So complete was the cure, at the end of six weeks, that the

external part of the artery did not show any mark of a wound, and the cicatrix was scarcely observable on the interior surface. In his 12th experiment he cut one-half of the circumference; the animal died; and so did it in several similar experiments. In experiment 13, he cut 3-4 of the circumference; after the animal was much reduced, the bleeding ceased, and the artery was closed in the same manner that it is when the section is complete.

"From these experiments, he concludes wounds of the arteries of dogs are cured by nature, when they are only occasioned by a puncture, or a longitudinal incision, whether the artery be denuded or not; but when arising from transverse incisions, they are always mortal if the artery be laid bare. If the artery retain its sheath, and the wound be 1-4, or 3-4 of the circumference, it may be cured by the efforts of nature; but it is always fatal, if 1-2 of it be cut through." (See *Quarterly Journ. of Foreign Medicine and Surgery*, Vol. 1, p. 26.) The inferences respecting the curability of a wound, extending through 3-4 of the circumference, and the incurability of one that affects only 1-2 of the circumference of the vessel, I should presume, must require further examination, notwithstanding an accidental faintness produced by the sudden loss of blood in the first instance may have been the means of saving one or two of the animals on which Beclard made his experiments.

This author thinks it probable, that a puncture, or longitudinal incision, in the artery of a man, may be cured by nature; but that a transverse wound never cicatrizes properly, but the clot becomes displaced, or, if a cicatrix be formed, it will be distended and torn.

One fact, made out by the same gentleman, is, that when an artery is deprived of its sheath for an extent greater, than its distance of retraction, the hemorrhage is mortal. I have not yet had time to look over the original paper; but it appears to me, that it would be desirable to know precisely to what sized arteries the author is referring, when he is making some of the above inferences. The size and condition of each animal, the subject of experiment, should also be particularly specified; as experiments made on the femoral artery of a lady's lap-dog would surely not have the same results, as those performed on the same artery of a large terrier, setter, or Newfoundland dog.

According to Dr. Jones, the lymph, which fills up the wound of an artery, is poured out very freely, both from the vessel and the surrounding parts, and it accumulates around the artery, particularly over the wound, where it forms a more distinct tumour. The exposed surrounding parts at the same time inflame, and pour out coagulating lymph, with which the whole surface of the wound becomes covered, and which completely excludes the artery from the external wound. This lymph granulates,

and the wound is filled up and healed in the usual manner. (See *Jones on Hemorrhage*, p. 113, &c.)

SURGICAL MEANS OF SUPPRESSING HEMORRHAGE.

It must be plain to every one, who understands the course of the circulation, that pressure, made on that portion of a wounded artery, which adjoins the wound towards the heart, must check the effusion of blood. The current of blood in the veins, running in the opposite direction, requires the pressure to be applied to that side of the wound, which is most remote from the heart. However, on account of the freedom and facility with which the blood is transmitted through the anastomoses, from the portion of the artery above the point of pressure into the lower continuation of the artery, such pressure will often only check, and not effectually stop the bleeding, unless the part of the vessel directly below the wound be also compressed, or secured. As pressure is the most rational means of impeding hemorrhage, so it is the most effectual; and almost all the plans, employed for this purpose, are only modifications of it. The tourniquet, the ligature, the application of a roller, and compresses, even agaric itself, only become useful in the suppression of hemorrhage, on the principle of pressure: the cautery, caustics, and styptics, however, have a different mode of operation.

In order to prevent a wounded person from dying of hemorrhage, Celsus advises the wound to be filled with dry lint, over which was laid a sponge dipped in cold water, and pressed on the part with the hand. If, notwithstanding these means, the hemorrhage should continue, he recommends repeatedly applying fresh lint, wet with vinegar; but, he is against the use of corroding escharotic applications, on account of the inflammation which they produce; or only sanctions the employment of the mildest ones. When the hemorrhage resists these methods, he advises two ligatures to be applied to the wounded part of the vessel, and then dividing the portion situated between them:—*“Quod si illa quoque profluvio vincunt, venæ, quæ sanguinem fundunt, apprehendendæ, circaque id, quod ictum est, duobus locis deligendæ, intereidendæque sunt, ut et in se ipse coeant, et nihilominus ora præclusa habeant.”* Lib. 5. cap. 26. When the ligature was impracticable, the wound bled dangerously, and there were no large nerves, nor muscles at the bleeding part, Celsus proposed the actual cautery.

Galen also mentions tying the vessels for the purpose of stopping hemorrhage; and there are some traces of the same information in other authors, who lived before him, as Archigenes, and Rufus. Probably, however, the ligature was little used at these early periods, as may be inferred from the multitude of astringents, caustics, and other applications, which were advised for stopping bleeding, and in which less confidence

would have been put, had the use of the ligature been familiarly known. No one can doubt, that if the old surgeons had had many opportunities of seeing the advantages of the ligature, they would soon have used it after amputations; but, so far were they from adopting such practice that, Albucasis, a long while afterward, refused to amputate at the wrist lest he should see his patient bleed to death.

Paré is considered as the first who regularly employed the ligature after amputation. His method having been attacked, he modestly defends it in the part of his works, intitled, *Apologie*, where he takes great care to impute the origin of it to the ancients, and cites many of them, who have made mention of it. However, he thinks its utility in amputations of such high consequence, that he ascribes to inspiration of the Deity his first adoption of this practice.

The method, in which the ancients placed most confidence, for stopping hemorrhage after the amputation of a limb, was the cauterization of the cut vessel, and surrounding flesh. The parts, thus affected by the heat, formed an eschar, of greater, or less thickness, which blocked up the opening of the vessel, and hindered the blood from escaping. The separation of the eschar, however, which frequently took place too soon, occasioned a return of the hemorrhage, and rendered it the more dangerous, as its suppression was now more difficult than before the cautery was applied. Sometimes, the instrument being too much heated, immediately brought away with it the eschar. At the present time, the cautery is never employed, as a means of suppressing hemorrhage, or, at most, only in a few very unusual cases, in which neither compression, nor the ligature can be made use of. In Great Britain, the cautery may be said to be entirely exploded; but, in France, the best hospital surgeons now and then employ it to stop bleedings from the antrum, and the mouth.

The old surgeons also very commonly applied to bleeding parts pledgets, dipped in boiling turpentine, a practice, that has long been most justly abandoned.

ASTRINGENTS, STYPTICS, &c.

Le Dran, in his treatise on the operations of surgery, says, that a button of vitriol, or alum, applied and properly confined on the extremity of the vessel, is sufficient to stop the hemorrhage in amputations. Heister recommends the application of vitriol, in preference to the ligature, in the amputation of the fore-arm. Great praises have also been conferred on agaric, and sponge, for their styptic properties. Solutions of iron, and all the mineral acids in various forms, have been recommended to the public, as remedies of the same kind, and possessing great efficacy. The ancients, centuries ago, left no application of this nature untried, and the pretended discoveries of new and more effectual styptics in latter times, may

almost all be met with in their writings. This fact merits particular notice, because the little success attending their practice, especially when bleeding from a considerable artery was to be suppressed, clearly proves what little reliance ought to be placed on means of this description. (*Encyclopédie Méthodique; Partie Chir.*) The most which styptics can do, is to stop hemorrhages from small arteries; but they ought never to be trusted when large vessels are concerned.

There is no doubt, that cold air has a styptic property: by which expression, I mean, that it promotes the contraction of the vessels; for no styptics can contribute to make the blood coagulate, though such an erroneous idea is not uncommon. We frequently tie, on the surface of a wound, every artery that betrays the least disposition to bleed, as long as the wound continues exposed to the air. We bring the opposite sides of this wound into contact, and put the patient to bed. Not an hour elapses, before the renewal of hemorrhage necessitates us to remove the dressings. The wound is again exposed to the air, and again the bleeding ceases. This often happens in the scrotum, after the removal of a testicle, and on the chest, after the removal of a breast. The proper conduct, in such cases, is not to open the wound unnecessarily, but to apply wet linen to the part so as to produce such an evaporation from its surface, as shall create a sufficient degree of cold to stop the bleeding. As all styptics are more or less irritating, no judicious practitioners apply them to recent wounds. However, for the suppression of hemorrhage from diseased surfaces, where the vessels seem to have lost their natural disposition to contract, these applications are sometimes indicated.

COMPRESSION.

We have already remarked, that all the best means of checking hemorrhage, operate on the principle of pressure; the actual and potential cautery, and some styptics excepted; the two first of which act by forming a slough, which stops up the mouths of the vessels; while the latter operate by promoting their contraction. Let us next consider the various modifications of pressure.

In a dissertation on the manner of stopping hemorrhage, printed in the *Mem. de l'Acad. de Sciences, année 1731*, Petit endeavoured to prove, that different articles praised as infallible specifics, would seldom or never have succeeded without compression. Even when caustics were employed, it was usual to bind compresses tightly on the part, so as to resist the impulse of the blood in the artery, and the premature separation of the eschar. Had this precaution not been taken, Petit believes, hemorrhage would almost invariably have followed, and indeed, notwithstanding the pains taken to avert it by suitable compression, it did but too frequently take place on the detach-

ment of the eschar. Petit has noticed, that the end of a finger gently compressing the mouth of a vessel, is a sufficient means of stopping hemorrhage from it, and that nothing else would be necessary, if the finger and stump could always be kept in this posture. Hence, he endeavoured to obviate these difficulties by inventing a machine which securely and incessantly executed the office of the finger. The instrument was a double tourniquet, which, when applied, compressed at once, both the extremity of the divided artery and its trunk above the wound. The compression on the end of the vessel was permanent; that on the trunk was made only at the time of dressing the wound, or when it was necessary to relax the other. An engraving and particular description of the instrument are to be found in Petit's memoir.

Surgeons formerly filled the cavities of wounds with lint, or charpie, and then made pressure on the bleeding vessels, by applying compresses and a tight roller, over the part. The practitioners of the present day are too well acquainted with the advantages of not allowing any extraneous substance to intervene between the opposite surfaces of a recent wound, to persist in the above plan. They know, that the sides of the wound may be brought into contact, and that compression may yet be adopted, so as both to restrain particular hemorrhages, and rather promote than retard, the union of the wound.

When the blood does not issue from any particular vessel, but from numerous small ones, compression is preferable to the ligature. In the employment of the latter, it would be necessary to tie the whole surface of the wound. The sides of the wound are to be brought accurately together, and compresses are then to be placed over the part, and a roller to be applied with sufficient tightness to make effectual pressure, but not so forcibly as to produce any chance of the circulation in the limb being completely stopped.

If, in bleedings from large arteries, compression can ever be prudently tried, it is when these vessels lie immediately over a bone. Bleedings from the radial and temporal arteries are generally cited as cases of this kind, though from the many instances of failure, which I have seen happen where the first of these vessels is concerned, I should be reluctant either to advise, or make such an attempt. Compression is sometimes tried, when the brachial artery is wounded in phlebotomy. Here it is occasionally tried, in preference to the ligature, because the latter cannot be employed without an operation to expose the artery.

When there is a small wound in a large artery, the following plan may be tried: a tourniquet is to be applied so as to command the flow of blood into the vessel. The edges of the external wound are next to be brought into contact. Then a compress, shaped like a blunt cone, and which is best formed of a series of compresses, gradually

increasing in size, is to be placed with its apex exactly on the situation of the wound in the artery. This *graduated compress*, as it is termed, is then to be bound on the part with a roller.

In this manner I once healed a wound of the superficial palmar arch, in a young lady in Great Pultney-street. The outward wound was very small, and though the hemorrhage was profuse, I conceived, that it might be permanently stopped, if compression could be so made as to keep the external wound incessantly and firmly covered for the space of a day or two. At first I tried a compress of lint, bound on the part with a roller; but this proving ineffectual, I took some pieces of money, from the size of a farthing to that of a half crown, and, wrapping them up in linen, put the smallest one accurately over the wound, so as completely to cover it. Then the others were arranged, and all of them were firmly confined with a roller, and the arm kept as quiet as possible in a sling. They were taken off after three days, and no hemorrhage ensued.

It is to be observed, that the palmar fascia, in this instance, would prevent the compression from operating on the vessel; but the case shows that this artery, when wounded, is capable of healing, if the blood be completely prevented from getting out of the external wound by the proper application of compression. Were the outer wound too large to admit of this plan, it would probably be the safest practice to cut down, at once, to the ulnar artery, and put a ligature round it, though as this would only certainly stop the bleeding from one end of the vessel in the hand, pressure on the wound would yet be necessary. I have never seen a surgeon succeed in taking up the artery in the hand.

Besides compressing the wounded part of the artery, some surgeons also apply a longitudinal compress over the track of the vessel above the wound, with a view of weakening the flow of blood into it. Whatever good effect it may have in this way is more than counterbalanced by the difficulty which it must create to the circulation in the arm. If the graduated compress be properly arranged, an effusion of blood cannot possibly happen, and pressure along the course of the artery must at all events be unnecessary. After relaxing the tourniquet, if no blood escape from the artery, the surgeon (supposing it to be the brachial artery wounded) should feel the pulse at the wrist, in order to ascertain that the compression employed is not so powerful as entirely to impede the circulation in the fore-arm and hand. The arm is to be kept quietly in a sling, and in forty-eight hours, if no bleeding take place, there will be great reason to expect that the case will do well. In another work, I have given an engraving and description of an instrument, invented by Plenck, for making pressure on the wounded brachial artery, at the bend of the arm, without pressing upon the whole circumfe-

rence of the limb, and consequently without stopping the circulation. No one, however, would prefer compression when large arteries are injured, except in the kind of cases to which we have just now adverted, or in those in which the wounded vessel can be firmly compressed against a subjacent bone. Sometimes the compresses slip off, or the bandages become slack, and a fatal hemorrhage may arise; and a still greater risk is that of mortification from the constricted state of the limb. When the method is tried, the tourniquet should always be left loosely round the limb, ready to be tightened in an instant. Sometimes the external wound heals, while the opening in the artery remains unclosed, and a false aneurism is the consequence.

TOURNIQUET.

When hemorrhage takes place from a large artery in one of the limbs, where the vessel can be conveniently compressed above the wound in it, a tourniquet, judiciously applied, never fails in putting an immediate stop to the bleeding.

Before the invention of this instrument, which did not take place till the latter part of the 17th century, surgery was really a very defective art. No important operation could be undertaken on the extremities, without placing the patient in the most imminent peril; and many wounds were mortal, which with the aid of this simple contrivance, would not have been attended with the least danger.

The first invention of this instrument has been claimed by different surgeons, and even different nations. But whoever was the inventor, it was first presented to the public in a form exceedingly simple; so much so, indeed, that it seems extraordinary that its invention did not happen sooner. A small pad being placed on the principal artery of a limb, a band was applied over it, so as to encircle the limb twice. Then a stick was introduced between the two circles of the band, which was twisted: thus the pad was made to compress powerfully enough completely to stop the flow of blood into the lower part of the vessel.

Although, in the *Armamentarium Chirurgicum* of Scultetus, there is a plate of a machine, invented by this author for compressing the radial artery by means of a screw, J. L. Petit is universally allowed to be the first who brought the tourniquet to perfection, by combining the circular band with a screw, so that the greatest pressure may operate on the principal artery.

The advantages of the modern tourniquet are, that its pressure can be regulated with the utmost exactness; that it operates chiefly on the point where the pad is placed, and where the main artery lies; that it does not require the aid of an assistant to keep it tense; that it completely commands the flow of blood into a limb; that it can be relaxed or tightened in a moment; and that,

when there is reason to fear a sudden renewal of hemorrhage, it can be left slackly round the limb, and, in case of need, tightened in an instant. Its utility, however, is confined to the limbs, and as the pressure necessary to stop the flow of blood through the principal artery, completely prevents the return of blood through the veins, its application cannot be made very long without inducing mortification. It is only of use also in putting a sudden stop to profuse hemorrhages for a time, that is, until the surgeon has put in practice some means, the effect of which is more permanent.

LIGATURE.

The ancients were quite unacquainted with the use of the tourniquet, and though some of their writers have made mention of the ligature, they do not seem to have known how to make proper use of it, nor to have possessed any other certain means of suppressing hemorrhage from wounds. In modern times it is easily comprehensible, that when any great operation was undertaken, while surgery was so imperfect, there was more likelihood of the patient's life being shortened than lengthened by what was attempted. Under these circumstances, it is not surprising, that the old practitioners should have taken immense pains to invent a great many topical astringents. But, now that the ligature is known to be a means which is safer and less painful than former methods, no longer search need be made for specifics against hemorrhage.

It may, indeed, be set down as a rule in surgery, that whenever large arteries are wounded, no styptic application should ever be employed, but immediate recourse had to the ligature, as being, when properly applied, the most simple and safe of all methods.

In order to qualify the reader to judge of the best mode of applying ligatures to arteries, I shall first explain to him their effect on these vessels, as related by Dr. Jones.

This gentleman learned from Dr. J. Thomson, of Edinburgh, that, in every instance in which a ligature is applied around an artery, without including the surrounding parts, the internal coat of the vessel is torn through by it, and that this fact had been originally noticed by Desault. Dr. Thomson showed to Dr. Jones, on a portion of artery taken from the human subject, that the internal and middle coats are divided by the ligature. (*Jones, p. 126.*)

This led Dr. Jones to make some experiments on the arteries of dogs and horses, tending to the conclusion, that when several ligatures are applied round an artery with sufficient tightness to cut through its internal and middle coats, although the cords be immediately afterward removed, the vessel will always become impervious at the part which was tied, as far as the first collateral branches above and below the obstructed part. Dr. Jones thinks it reasonable to expect, that the obstruction produced in the

arteries of dogs and horses, in the manner he has related, "might be effected by the same treatment in the arteries of the human subject; and, if it should prove successful, it might be employed in some of the most important cases in surgery. The success of the late important improvements which have been introduced in the operation for aneurism, may perhaps appear to most surgeons to have rendered that operation sufficiently simple and safe; but if it be possible to produce obstruction in the canal of an artery of the human subject, in the above-mentioned manner, may it not be advantageously employed in the cure of aneurism; inasmuch as nothing need be done to prevent the immediate union of the external wound?" Dr. Jones next questions, whether this mode of obstructing the passage of blood through the arteries may not also be advantageously practised in cases of bronchocele? (*P. 136.*)

Subsequent experimenters, as a late writer observes, have not, however, been equally successful with Dr. Jones in obtaining the obliteration of the cavity of the vessel after this operation. Mr. Hodgson tried the experiment in two instances upon the carotid arteries of dogs; and in neither of them was the cavity of the vessel obliterated. The same experiment has been repeated by several surgeons upon the arteries of dogs and horses; but, in no example, as far as Mr. Hodgson knows, has the complete obliteration of the cavity of the vessel been accomplished. "It appears, however, that an effusion of lymph is an invariable consequence of the operation: the want of union is therefore owing to the opposite sides of the vessel not being retained in a state of contact, so as to allow of their adhesion. (See *Observations on the Application of the Ligature to Arteries, &c. by B. Travers, Vol 4, Med. Chir. Trans.*) The presence of the ligature, in the common mode of its application, effects this object; and for the success of Dr. Jones's experiment, it appeared only necessary, that the opposite sides of the wounded vessel should be retained in contact, until their adhesion is sufficiently accomplished to resist the passage of the blood through the tube. This object might probably be effected by compression; but the inconveniences attending such a degree of pressure as shall retain the opposite sides of an artery in contact at the bottom of a recent wound, are too great to permit its employment. It occurred to Mr. Travers, that if a ligature were applied to an artery, and suffered to remain only a few hours, the adhesion of the wounded surfaces would be sufficiently accomplished to ensure the obliteration of the canal; and by the removal of the ligature at this period, the inconveniences attending its stay would be obviated. The danger produced by the residence of a ligature upon an artery, arises from the irritation which, as a foreign body, it produces in its coats. Ulceration has never been observed to commence in less than twenty-four hours after the application

of a ligature; whilst it is an ascertained fact, that lymph is in a favourable state for organization in less than six hours, in a wound, the sides of which are preserved in contact. (*Jones, chap. 4, exp. 1*) If it be sufficient, therefore, to ensure their adhesion, that the wounded coats of an artery be kept in contact by a ligature only three or four hours, ulceration and sloughing may in a great degree be obviated by promoting the immediate adhesion of the wound. Justified by this reasoning, Mr. Travers performed several experiments, by which he ascertained that if a ligature be kept six, two, or even one hour upon the carotid artery of a horse, and then removed, the adhesion was sufficiently advanced to effect the permanent obliteration of the canal. It appeared probable, that the same result would be obtained upon the healthy artery of a human subject. (*Hodgson on the Diseases of Arteries, &c. p. 228, et seq.*) Mr. A. C. Hutchison, in the year 1800, tied the brachial arteries of two dogs, and removed the ligatures immediately after their application. In both instances, the complete obliteration of the canal of the artery was the consequence of the operation. (See *Practical Observations in Surgery, p. 103.*) He has also tried this method, as modified by Mr. Travers, in an operation which he performed for a popliteal aneurism in a sailor, in Nov. 1813. A double ligature was passed under the femoral artery. The ligatures were tied with loops, or slip-knots, about a quarter of an inch of the vessel being left undivided between them. All that now remained of the pulsation in the tumour was a slight undulatory motion. Nearly six hours having elapsed from the application of the ligatures, the wound was carefully opened, and the ligatures untied and removed without the slightest disturbance of the vessel. In less than half a minute afterward, the artery became distended with blood, and the pulsations in the tumour were as strong as they were before the operation. Mr. Hutchison then applied two fresh ligatures; hemorrhage afterward came on; amputation was performed, and the patient died. (See *Practical Observations in Surgery, p. 102. &c.*) Now as Mr. Hutchison chose to apply other ligatures, on finding that the pulsation returned, the above case only proves, that the artery is not obliterated in about six hours, and we are left in the dark respecting the grand question, namely, whether the vessel would have become obliterated by the effusion of coagulating lymph, and the adhesive inflammation, notwithstanding the return of circulation through it. As for the hemorrhage which occurred, I think it might have been expected, considering the disturbance and irritation which the artery must have sustained in the proceedings absolutely necessary for the application of not less than four ligatures, and the removal of two of them. According to my ideas, only one ligature ought to have been used, and none of the artery detached. We also have no description of the sort of ligatures which

were employed; an essential piece of information in forming a judgment of the merits of the preceding method. The application, removal, and reapplication of ligatures are not consistent with the wise principles inculcated by the late Dr. Jones, and have in more instances than that recorded by Mr. Hutchison, brought on ulceration of the artery and hemorrhage.

From Dr. Jones's experiments, it appears, that the first effects of a ligature upon an artery are, a complete division of its internal and middle coats, an apposition of its wounded surfaces, and an obstruction to the circulation of the blood through its canal. There must be a small quantity of stagnant blood, just within the extremity of the artery; but this does not, in every instance, immediately form a coagulum, capable of filling up the canal of the artery. In most cases, only a slender coagulum is formed at first, which gradually becomes larger by successive coagulations of the blood; and hence, the coagulum is always at first of a tapering form, with its base at the extremity of the artery. But, as Dr. Jones remarks, the formation of this coagulum is not material; for soon after the ligature has been applied, the end of the artery inflames, and the wounded internal surface of its canal being kept in close contact by the ligature, adheres, and converts this portion of the artery into an impervious, and, at first, slightly conical sac. It is to the effused lymph that the base of the coagulum adheres, when found to be adherent. Lymph is also effused between the coats of the artery, and among the parts surrounding its extremity. In a little time, the ligature makes the part on which it is directly applied ulcerate; and, acting as a tent, a small aperture is formed in the layer of lymph effused over the artery. Through this aperture, a small quantity of pus is discharged, as long as the ligature remains; and, finally, the ligature itself also escapes, and the little cavity which it has occasioned, granulates and fills up, and the external wound heals, leaving the cellular substance a little beyond the end of the artery much thickened and indurated. (*Jones, p. 159 161.*)

In short, when an artery is properly tied, the following are the effects, as enumerated by Dr. Jones:

1. To cut through the internal and middle coats of the artery, and to bring the wounded surfaces into perfect apposition.

2. To occasion a determination of blood to the collateral branches.

3. To allow of the formation of a coagulum of blood just within the artery, provided a collateral branch is not very near the ligature. It merits particular notice, however, that though the nearness of a collateral branch prevents the formation of a coagulum, it cannot always prevent the completion of the adhesive process. In the experiments made on the arteries of horses and dogs by Mr. Travers, the ligature was purposely applied close to large collateral branches, yet the vessels were safely obliterated. (See *Med. Chir. Trans. Vol. 6, p. 658, 660.*)

4. To excite inflammation on the internal and middle coats of the artery, by having cut them through, and, consequently, to give rise to an effusion of lymph, by which the wounded surfaces are united, and the canal is rendered impervious; to produce a simultaneous inflammation on the corresponding external surface of the artery, by which it becomes very much thickened with effused lymph; and, at the same time, from the exposure and inevitable wounding of the surrounding parts, to occasion inflammation in them, and an effusion of lymph, which covers the artery, and forms the surface of the wound.

5. To produce ulceration in the part of the artery, around which the ligature is immediately applied, viz. its external coat.

6. To produce indirectly a complete obliteration, not only of the canal of the artery, but even of the artery itself, to the collateral branches on both sides of the part which has been tied.

7. To give rise to an enlargement of the collateral branches. (*Jones, p. 163, 164.*)

Every part of an artery is organized in a similar manner to the other soft parts, and its coats are susceptible of the same process of adhesion, ulceration, &c. as the other parts are. Hence, the precautions taken to secure the adhesion of other parts, should be observed for the same purpose with regard to an artery. The vessel is put in a state to admit of adhesion by the ligature, which, when properly applied, cuts through its internal and middle coats, keeps their cut surfaces in contact, and affords them an opportunity of uniting by the adhesive indammation, as other cut surfaces do. The immediate stoppage of the bleeding is merely the incipient and temporary part of what the ligature has to accomplish; it has also to effect the adhesion of the internal and middle coats of the artery, which being the thing on which the permanent suppression of hemorrhage depends, is the most important. The size and form of the ligature, whether completely flat or irregular, have not been, as Dr. Jones remarks, sufficiently attended to; nor is the degree of force employed in tying the artery, often considered. Some surgeons, wishing to guard against the ligature's slipping off, tie it with very considerable force; while others, apprehensive lest they should cut through the artery, or occasion too early a separation of the ligature, draw it only sufficiently tight to prevent the escape of any blood. A broad flat ligature is not likely to make such a wound in the internal and middle coats of the artery, as is most favourable to adhesion, because it is scarcely possible to tie it smoothly round the vessel, which is very likely to be thrown into folds, or puckered by it, and, consequently, to have an irregular bruised wound made in its middle and internal coats. By covering also a considerable space of the external coat, it may destroy the very vessels which pass on it in their way to the cut surfaces of the inner coats, and thus render them incapable of inflaming. Even supposing the wound to unite,

still such a ligature may cover that part of the external coat which is directly over the newly-united part, and, consequently, as soon as it has produced ulceration through the external coat, it will cause the same effect on the newly-united parts, and, of course, secondary hemorrhage. (*Jones, p. 168.*)

When a ligature is of an irregular form, it is apt to cut through the internal and middle coats of an artery more completely at some parts than others; but these coats must be perfectly cut through, in order to produce an effusion of lymph from the inside of the vessel, which seems to adhere most securely at its cut surfaces.

Also, when the ligature is not applied with sufficient tightness, the inner coats of the artery will not be properly cut through. Dr. Jones thinks, that the ligature being sometimes put on so as to deviate from a circle, has a tendency to produce secondary hemorrhage.

Dr. Jones conceives that ligatures are best when they are round, and very firm, and he adds, that though a very slight force is necessary to cut through the internal and middle coats of an artery, it is better to tie the vessel more tightly than is necessary, merely to cut through its inner coats, because the cut surfaces will thus be more certainly kept in contact; the separation of the ligature expedited; and the danger of ulceration spreading to the newly-cicatrized part diminished. The external coat will never ulcerate through, before the inner ones have adhered. The limb, however, should be kept in a perfectly quiet state.

I am sincerely glad to find, that so accurate an observer as Dr. Jones, has refuted the idea, that ligatures occasionally slip off the vessels, in consequence of the violent impulse of the blood. In fact, the blood does not continue to be impelled against the extremity of the artery with the same impetuosity with which it circulated through the vessel before it was tied. The blood is immediately determined into the collateral branches, nor is there any pulsation for some way above the ligature.

Dr. Jones much more rationally imputes^s this occasional accident, either to the clumsiness of the ligature, which prevents its lying compactly and securely round the artery; or to its not having been applied with sufficient tightness; or to its having that very insecure hold of the vessel, which the deviation from the circular application must occasion. (*P. 173.*)

Dr. Jones is of opinion, that in cases of aneurism, in which the artery has only been tied with one ligature, and left undivided, and in which secondary hemorrhage has arisen, that this has most probably been owing, either to a diseased state of the artery; to various contrivances for compressing a large portion of the vessel; to having a loose ligature above the one which is tied; or, lastly, to not tying the artery sufficiently tight to cut through the internal and middle

coats, so as to fit them for adhesion, but so as to cause a gradual ulceration through them, and, of course, bring on hemorrhage, which returns with greater violence as the ulceration advances. (P. 176.)

These reflections must also obviously explain why Scarpa's practice of using a largish ligature, with the intervention of a piece of cloth between the cord and the vessel, for the express purpose of hindering the inner coats of the vessel from being divided, must be objectionable, because it may be set down as an axiom in all operations, where large arteries are to be tied, that the quantity of extraneous substances in the wound, and particularly of such as are in contact with the artery, should be diminished as much as possible. And though I may be disposed to go so far with Scarpa as to believe, that the interposition of a piece of cork or wood is worse than that of a cylinder of linen, I cannot accede to the proposition, that the latter is free from objection, because it rather acts as a cushion, than as a body likely to bruise. (See *Mém. On the Ligature of Arteries*, p. 44.)

With the differences in the constitutions of man and animals, I know that the results of experiments on the latter can never be looked upon as a positive proof of what would happen from the same experiments performed on the human subject. The stronger or weaker impulse of the heart, the more or less coagulable nature of the blood, the greater or lesser degree of general and local irritability; the more or less quick tendency to adhesive inflammation and ulceration; are circumstances which must make in different animals the same experiments lead to opposite results. The question, whether a small round ligature, or a larger flat one, with a piece of linen between it and the vessel, be best, must therefore after all be decided, not by Dr. Jones's experiments, nor those of Scarpa, or Mislei, but by the practice of surgery on the human body; and that the principles defended in this Dictionary are on the whole to be preferred, can hardly be questioned by any man, who knows how much less frequent secondary hemorrhage now is in this metropolis, than it was formerly when those principles were neither observed, nor comprehended. (See *Amputation, Aneurism, Arteries, and Ligature*.)

Dr. Jones seems to consider, that the advantage of the retraction of the divided artery within the cellular membrane, is compensated, in the case of the undivided artery, by the speedy and profuse effusion of lymph, which takes place over and round the vessel, at the tied part, and even covers the ligature itself. Another cause of secondary hemorrhage, is the including of other parts in the ligature, together with the artery, by doing which, the division of the inner coats of the vessel may be prevented.

In the valuable publication of Dr. Jones, to which I have so freely adverted, some secondary hemorrhages are also imputed to the hidden separation, or laceration of the

recently united parts of an artery, by premature and extraordinary exertions of the patient. Hence, he strongly insists on keeping a limb, in which a large artery has been tied, perfectly at rest.

I shall conclude these remarks on the ligature with a few practical rules.

1. Always tie a large artery as separately as possible, but still let the ligature be applied to a part of the vessel, which is close to its natural connexions.

Besides the reasons for this practice, already specified, we may observe, that including other substances in the ligature causes immense pain, and a larger part of a wound to remain undisunited. The ligature is also apt to become loose, as soon as the substance between it and the artery sloughs, or ulcerates. Sometimes the ligature thus applied, forms a circular furrow in the flesh, and remains a tedious time, incapable of separation.

The blood-vessels being organized like other living parts, the healing of a wounded artery can only take place favourably, when that part of the vessel, which is immediately contiguous to the ligature, continues to receive a due supply of blood through its vasa vasorum, which are ramifications of the collateral arteries. Hence, the disadvantage of putting a ligature round the middle of a portion of an artery, which has been separated from its surrounding connexions; and hence, the utility, of making the knot as closely as possible to that part of the vessel which lies undisturbed among the surrounding flesh.

Small arteries neither allow, nor require, these minute attentions to the mode of tying them.

2. When a divided artery is large, open-mouthed, and quite visible, it is best to take hold of it, and raise its extremity a little way above the surface of the wound with a pair of forceps. When the vessel is smaller, the tenaculum is the most convenient instrument.

3. While the surgeon holds the vessel in this way, the assistant is to place the noose of the ligature round it, and tie it according to the above directions. In order that the noose may not rise too high, and even above the mouth of the artery, when it is tightened, the ends of the ligature must be drawn as horizontally as possible, which is best done with the thumbs. A knot is next to be made.

4. As ligatures always operate in wounds as extraneous bodies, and one half of each is sufficient for the removal of the noose when detached, the other should always be cut off close to the knot, and taken away.

As we have explained in the article *Amputation*, and as we shall notice again in speaking of the *Ligature*, trials have of late years been made of the practice of cutting off both ends of the ligature close to the knot, with a view of diminishing, as far as possible the quantity of extraneous sub-

stances in the wound. This plan requires the use of very small silk ligatures, in order to be duly judged of. (See *Mr. Lawrence's Obs. in Medico-Chir. Trans. Vol. 6, p. 156, et seq.*)

5. When a large artery is completely divided, two ligatures, one to the upper, the other to the lower part of the vessel, are commonly necessary, in consequence of the anastomosing branches conveying the blood very readily into the part of the artery most remote from the heart, as soon as the first ligature has been applied.

6. When a large artery is only punctured, and compression cannot be judiciously tried, the vessel must be first exposed by an incision, and then a double ligature introduced under it, with the aid of an eye-probe. One ligature is to be tied above; the other below the bleeding orifice; with due attention to the principles explained in this article, and that on *Aneurism*.

7. Ligatures usually come away from the largest artery ever tied, in about a fortnight, and from moderate-sized ones, in six or seven days. When they continue attached much beyond the usual period, it is proper to draw them very gently every time the wound is dressed, for the purpose of accelerating their detachment. Great care, however, is requisite in doing this; for, as Dr. Jones remarks, as long as the ligature seems firmly attached, pulling it rather strongly must act, more or less, on the recently cicatrized extremity of the artery, which is not only contiguous to it, but is still united to that portion of the artery, (the external coat) which detains the ligature. (*Jones, p. 162.*)

In particular individuals, there appears to be an extraordinary tendency to profuse hemorrhage from very slight injuries. An instance of this kind was lately recorded by Mr. Blagden, where a fatal hemorrhage arose from the extraction of a tooth. The patient, who was twenty-seven years of age, had had a tooth extracted when a boy, in consequence of which operation, the bleeding continued for twenty-one days, from the socket, before it ceased. A very slight cut on the head was also followed by an alarming bleeding, which could not be stopped by pressure, styptics, or the ligature, so that it became necessary to apply the *kali purum*, which succeeded. On his having another carious tooth taken out, a profuse bleeding followed, which resisted the effect of styptics, caustic, and every means adopted to stop up the socket. The actual cautery was tried in vain. The dangerous condition of the patient seemed to leave no other resource, but that of tying the carotid artery, which was done by Mr. Brodie. But even this proceeding failed to suppress the hemorrhage, which proved fatal. (*Vid. Med. Chir. Trans. Vol. 8, p. 224, London, 1817.*) On the mode of stopping hemorrhage from the sockets of the teeth, the reader may find some remarks in the *Einb. Med. and Surg. Journ. No. 58, p. 157.*

The hemorrhage from the bites of leeches sometimes proves exceedingly obstinate, and

instances of death from this cause have occasionally happened, particularly in children. When common methods fail, the plan has been recently tried of passing a fine sewing-needle through the skin on one side of the wound, and then another through the skin on the opposite side, and then twisting some thread round the needles, so as to draw them together, and close the bite. The experiment fully answered. (*See Lond. Med. Repository, January, 1819, p. 23—26.*)

For more information, respecting hemorrhage, see *Amputation, Aneurism, Arteries, Ligature, and Wounds.*

Consult also *Petit's Memoirs*, among those of *l'Acad. des Sciences* for the years 1731, 1732, —1735: *Morand sur le Changement, qui arrive aux Arteries coupées*, 1736: *Pouletau. Mélanges de Chirurgie*: *Gooch's Chirurgial Works, Vol. 1.*: *Kirkland's Essay on the Method of suppressing Hemorrhages from divided Arteries*, 8vo. Lond. 1763: *White's Cases in Surgery*: *J. Bell's Principles of Surgery, Vol. 1.*: *Partie Chirurgicale de l'Encycl. Méth.*: *Larrey, Mémoires de Chirurgie Militaire, Tom. 2, p. 379.* *Pelleton, Clinique Chir. T. 2, p. 240, &c. Mémoire Élémentaire sur les Hemorrhagies.* *Richerand, Nosographie Chir. T. 4. Sect. sur les Maladies des Artères, p. 23, &c. Edit. 4. Léveillé, Nouvelle Doctrine Chir. T. 1, Chap. 3, and, particularly, Jones on the Process employed by Nature, in suppressing the Hemorrhage from divided and punctured Arteries, 1805. Many useful remarks on the subject of hemorrhage will be found in Hodgson's Treatise on the Diseases of Arteries and Veins. See also Observations upon the Ligature of Arteries, and the cause of secondary Hemorrhage, &c. by F. Travers, in *Med. Chir. Trans. Vol. 4, p. 485, et seq.* Likewise further observations on the ligature of Arteries, by the same, in *Med. Chir. Trans. Vol. 6, p. 632, et seq.* *Lawrence on a New Method of Tying the Arteries in Aneurism, Amputation, &c. in Vol. 6, of the Med. Chir. Trans. p. 156, &c. and Crampton in Vol. 7, of the same work.* *Langenbeck, Bibl. B. 1. Dr. J. Thomson's Lectures on inflammation, p. 250, &c. and Observations made in the Military Hospitals in Belgium, p. 42—44. Scarpa on Aneurism, and particularly his Memoir on the ligature of Arteries: this is contained in the Second Edit. of the Transl. by Mr. Wishart. Beclard, Expériences sur les Blessures des Artères. John Cross. A Case of Amputation, with some Experiments and Observations on the securing of Arteries with minute silk ligatures, in *Lond. Med. Repository, Vol. 7, p. 353.* The author relates several experiments for the purpose of ascertaining the utility of tying arteries with such ligatures, and cutting the two ends off close to the knot. They were performed on the carotids of dogs and asses. The conclusions are unfavourable to the practice. After one case of amputation, where the method was tried, the stump healed slowly, and for several months small abscesses repeatedly formed.**

HEMORRHOIDS. (from *aipein*, blood, and *paen*, to flow,) Piles, divided into such as do not bleed, and termed *blind*, and into others

subject to occasional hemorrhage, and distinguished by the epithet *open*. The etymological meaning of the word is evidently only a discharge of blood. Surgeons, however, sanctioned by long custom, have generally implied, by the term *hemorrhoids*, either a simple bleeding from the veins of the lower part of the rectum recurring more or less frequently, yet not accompanied with any distinguishable permanent tumours, within, or on the outside of the anus; or else swellings formed by a varicose distention and morbid thickening of those vessels, either with, or without occasional hemorrhage; or lastly, tumours, originally produced by effused blood, which is sometimes converted into an organized substance. (*Abernethy, Surgical Works, Vol. 2, p. 234.*)

According to Richter, blind hemorrhoids consist of preternatural cysts, or sacs, at the lower extremity of the rectum, from the size of a pea to that of an apple. Sometimes they are distended with blood, and very much swelled; and, at other periods, entirely subside; though, when they have been often considerably swelled, they never quite disappear, but are alternately in a full enlarged state, and empty and flaccid. Indeed, the more frequent and considerable the enlargement has been, the greater is their size. It is generally supposed, that these tumours, or cysts, are varicose expansions of the veins of the rectum; and probably, says Richter, this may sometimes really be the case; but the disease is not always of this nature. In particular instances, and perhaps, in most cases, they arise from an extravasation of blood under the inner coat of the rectum; and then the cyst is altogether formed by this membrane, and not by the vein. The following circumstances furnish proof of what has been here observed. Hemorrhoids are sometimes as large as a walnut, or apple; yet it is scarcely credible, that a mere varix could attain such a size. When cut away, the bleeding is often very slight, even when they are large. Surely, if the tumours were varices, there would always be profuse hemorrhage. Sometimes the cyst is found quite empty; but how can a varix be supposed to be in this state? The shape of hemorrhoids is also remarked to be subject to greater variety, than can hardly attend dilations of veins: thus, they are sometimes oblong, sometimes cylindrical, like a finger, &c. Lastly, when cut away, the sac is plainly seen to consist only of a single membrane. (*Anfangsgr. der Wundarzn. B. 6, p. 395, Ed. 2, Goll. 1802.*)

At the same time it should be recollected, that "the blood sometimes coagulates in the dilated vein, and the swelling becomes hard, inflamed, and very painful. The coagulum is subsequently absorbed, but the thickened coats of the vein, and the surrounding parts, form a tumour, which is little liable to inflame, and afford great distress." (*Hodgson on Diseases of Arteries, &c. p. 566.*) In short, all surgeons, who consider the disease as varices, admit with Sir E. Home, that in cases of long standing,

the contents of hemorrhoidal tumours "coagulate, and become solid; their coats increase in thickness, and they resemble pendulous excrescent tumours in other situations in the body." (*On Ulcers, &c.*) Availing himself of the extensive opportunity afforded by his dissecting room, Mr. Kirby has taken some pains to ascertain the nature of these tumours; and he observes, "I cannot say, that they seemed to be formed of a varicose distention of the great hemorrhoidal vein, even in a single instance. In every case of external hemorrhoids, the tumour appeared to be composed of a prolongation of the cellular substance in a state of unusual firmness, surrounded by some veins, and covered by the integuments. The veins were branches of the internal iliac. In every case of internal hemorrhoid, the structure was pretty similar: the veins, however, seemed enlarged, and were branches of the hemorrhoidal." (*On certain severe Forms of Hemorrhoidal Excrescence, p. 40.*)

The opinion, that piles are formed of cells filled with blood, is also adopted by Dr. Ribes. The distention of the hemorrhoidal veins with blood, he observes, gives rise to varices; but, if any of their blood is extravasated in the cellular membrane, at the inferior and internal part of the anus, hemorrhoids are the result. If the inferior mesenteric vein be dissected in hemorrhoidal patients, the ramifications of the vessel are seen terminating in the cysts of blood, and, on completely removing the whole, the hemorrhoids appear suspended from the branches of the vein, as grapes from the vine. (See *Révue Méd. T. 1, Ser. 1820.*) Montegre, well known as the author of a copious treatise on the present subject, is the only writer who defines a hemorrhoid to be a preternatural determination of blood (*fluxion sanguine*) to the extremity of the rectum, because he conceives, that hemorrhage, swelling, &c. are accidental circumstances, not constantly attending the disease. (See *Dict. des Sciences Méd. T. 20, p. 445.*)

Whether the account of some piles being formed of distinct cysts, or sacs of blood be correct, or not, there is no doubt, that the tumours sometimes consist of a varicose enlargement of the branches of the hemorrhoidal veins. Were this not the fact, how could cases like the following ever take place? "One of my patients (says M. Delatour) had several of these tumours of very large size, and at every contraction of the sphincter ani, the blood issued from them *per saltum*." (*Hist. Phil. Obs. 212.*) Montegre has likewise seen two instances, in which the blood spouted out of the tumours in a continued stream. (*Dict. des Sciences Méd. T. 20, p. 453.*) And Richerand mentions a merchant who lived to the age of eighty-nine, quite free from infirmity, and whose good health was ascribed to periodical bleedings from piles, during fifty years of his life; the evacuation being very regular, and so profuse, that the blood was thrown some distance, as from a vein opened in

phlebotomy. (See *Nosogr. Chir.*) If many piles were not either varices, or cysts in direct communication with the large veins of the rectum, Petit would not have succeeded in taking blood from them by puncture, as he often did in lieu of the ordinary mode of venesection. (*Mal. Chir. T. 2, p. 134.*)

Hemorrhoids vary in number, size, form, and situation; some being *external*; others, *internal*; and some hardly larger than a pea, while others exceed a hen's-egg in size. Sometimes they bring on very serious complaints, either by bursting and discharging blood so profusely as dangerously to reduce the patient; or by exciting inflammation of the adjacent parts, and causing abscesses and fistulæ; or, lastly, by becoming strangulated by the contraction of the sphincter ani, so as to occasion severe pain. Piles, which bleed but little, are not of much consequence; but those which bleed profusely, cause violent pain, or which induce inflammation, and all its effects, demand the greatest attention. Lieutaud mentions a person, who lost three quarts of blood from some piles in the course of a couple of days; and the heretic Arius, and the celebrated philosopher Copernicus, are said to have bled to death in this manner.

I do not know what credit ought to be given to the extraordinary case cited by Panaroli, in which a Spanish nobleman voided every day for four years a pint of blood from some hemorrhoids, and yet enjoyed perfect health! (See *Obs. Chir. Pentec. 2, Obs. 46.*) For other curious facts of this nature, see *Dict. des Sciences Med. T. 20, p. 458.*

In general, when piles are situated far up the rectum, they are less painful than when low down. In the former case, the veins or tumours are surrounded by soft and yielding substances, which do not make any painful pressure on them; but when they are situated towards the anus, they often suffer painful constriction from the action of the sphincter muscle. In fact, when they are quite within the rectum, the patient has sometimes no warning of his disorder, till he discharges blood from the anus.

With regard to the cause of hemorrhoids, any thing capable of retarding the return of blood through the hemorrhoidal veins, may occasion the disease. The pressure of the gravid uterus, costiveness, and the frequent retention of hardened feces in the rectum, are very frequent causes. Persons, who lead sedentary lives, are often troubled with the complaint. Hence, women are more subject to piles, than men.

The pressure of an enlarged liver, or of water accumulated in the cavity of the peritonæum, it is said, may occasion piles.

I have adverted to the opinion of Montegre, that hemorrhoids depend upon a determination of blood to the lower part of the rectum, which sentiment is perhaps correct in cases, where the disease arises from irritation in that bowel, or the neighbouring parts.

When these tumours are produced by the

pressure of the gravid uterus, no cure can be expected till after delivery, when one generally follows spontaneously. Also, when piles are an effect of dropsy, they cannot get well before the pressure of the fluid in the abdomen has been removed by tapping. Gently laxative medicines, and an horizontal position of the body, commonly alleviate the uneasiness resulting from hemorrhoids. The application of an ointment, composed of equal parts of the powder of oak-galls, and of elder-ointment, or hog's-lard, contribute to the same beneficial effect. The application of warm water by means of a bidet, or semicupium, is also frequently productive of great ease. When piles are constricted by the sphincter ani muscle, the pain may often be at once removed, by pushing the swellings up the rectum. When the disease is in a state of inflammation, leeches applied to the vicinity of the anus, and puncturing the dilated hemorrhoidal vessels with a lancet, for the purpose of taking away blood, and the application of cold lotions, are measures occasionally employed to procure ease. The usefulness of leeches was particularly noticed by Schmucker. (*Vermischte Chir. Schriften, B. 1, p. 107.*) Petit preferred the lancet.

When the number and size of hemorrhoids are so considerable, as materially to obstruct the discharge of the feces; when they are severely painful, and subject to profuse bleedings; when the patient is disabled from following his usual occupations; and when the above means afford insufficient relief, the surgeon should recommend their removal.

The extirpation of piles with the actual cautery and caustics, as practised by the old surgeons, is now altogether relinquished. The only plan, ever followed in the present state of surgery, is either to cut the tumours off with a pair of scissors or knife, or to apply a tight ligature round their base, so as to cause them to slough away. If possible, the opportunity of doing either of these operations should always be taken when the disease is in a tolerably quiet state.

When piles are to be cut off, and they are not sufficiently visible, the patient must first strain, as at stool, in order to make the swellings more apparent. With the aid of a pair of dissecting forceps, the skin, covering the hemorrhoids, is then to be separated from them with the knife, but not cut away, and the tumours, being taken hold of with a tenaculum, are to be removed. Sabatier states, that saving the skin is very essential; for any hemorrhage which may arise, can then be more easily suppressed; and, when there are several hemorrhoids to be extirpated, the loss of substance about the anus will be less, and of course, the patient will not be so liable to a contraction of this part, which is sometimes a very great affliction.

Previously to the performance of any operation, Mr. Abernethy endeavours to bring the bowels into a more regular state, and takes care to clear them with any medi-

cine, found by experience to answer the purpose without inducing a continuance of irritation and purging. "The bowel being everted to the utmost by the efforts used in evacuating the feces, and the parts cleansed by bathing with tepid water, the piles should be taken hold of with a double hook, and removed by a pair of scissors. A protruded and thickened plait of the bowel may be removed in the same way; but I think it is best to use the bistoury in removing it, because the depth, to which the scissors may cut, is uncertain. The incision, made by the knife, resembles two curved lines, joined at each extremity." The direction of the incision, both for the removal of piles, and that of plaits, he says, should be longitudinal, in the direction of the bowel. When there is a transverse fold of the bowel of considerable extent, he prefers taking away two elliptical portions in the long axis of the rectum. (See *Abernethy's Surgical Works*, Vol. 2, p. 239.)

As I have explained in the former part of this work, (see *Anus*, *Prolapsus* of) the late Mr. Hey used to remove these extensive diseased folds, about the verge of the anus, with great success. J. L. Petit used to follow the same practice, (*Mal. Chir. T. 2*, p. 134;) and more recently, Mr. Kirby. (*Obs. on the Hemorrhoidal Excrescence*, Lond. 1817.)

The late Mr. Ware, published some remarks on the present subject, and the tenor of what he says is to prove, that when there are several hemorrhoids, the removal of one, or two of the most painful of them, with a pair of scissors, will afford effectual relief. The same author asserts, that when the pain of hemorrhoids is not violent, but there is a constant distressing uneasiness, with frequent returns of a profuse debilitating hemorrhage, this method will frequently produce a radical cure.

The excision of piles is occasionally followed by dangerous bleeding, as a case, related by Petit, confirms. A patient had some hemorrhoids, which were supposed to be external, while they were only temporarily protruded. Almost immediately after they had been cut off, the skin which had supported them, was drawn inward. An internal hemorrhage ensued, which could not be suppressed, and proved fatal in less than five hours. The rectum and colon were found full of black, coagulated blood. Sir E. Home speaks also of some instances within his knowledge, where after the removal of internal piles with the knife, the bleeding endangered life. (*On Ulcers*, p. 365.)

If the bleeding should prove troublesome, and proceed from vessels within the rectum, the best plan would be to distend the gut with a suitable piece of sponge, so as to make pressure on the wound. Cold should also be applied to the sacrum and nates.

The removal of hemorrhoids, with a ligature, may generally be done with sufficient safety; but still it has its inconveniences, though they are not constant. Petit frequently practised this method, without any

ill effects. In other instances, he had reason to repent of having adopted it. A woman, for whom he had tied three hemorrhoids with narrow pedicles, which were favourably situated for this operation, did not at first experience a great deal of pain. However, five hours afterward he was informed, that she suffered violent colic pains, which extended along the colon. She was bled four times, without material relief. At last, Petit cut the ligatures, which could not be loosened, in consequence of their being concealed so deeply in the substance of the swollen parts. The pain very soon subsided. The ligatures had only been applied four and twenty hours, but the piles had become black, and the skin covering their bases was cut through. Petit then removed them, without the least effusion of blood.

Petit also relates a case, in which a patient, after having had some piles tied, died of symptoms resembling those which take place in cases of strangulated herniæ, notwithstanding the ligatures were cut as in the foregoing instance. After these two cases, Petit abandoned the practice of tying hemorrhoids. Mr. Kirby has mentioned two cases, proving the ill effects sometimes arising from the ligature of piles: in one of these examples, the patient's life was saved with great difficulty; and in the other, the operation was followed by tetanus and death. (*Obs. on the Treatment of certain severe Forms of Hemorrhoidal Excrescence*, p. 1—3, 8vo. Lond. 1817.)

I believe, on the whole, that it is best to remove hemorrhoids with a knife, unless they are situated high up the rectum, where the veins are of large size, and likely to bleed profusely. If a tumour so situated should absolutely require removal, which can rarely happen, a ligature might be put round its base with the aid of a double cannula, as is sometimes done in cases of uterine *Polypi*. When the base of the tumour, however, is large, admits of being brought into view, and the surgeon prefers tying it, he should pass a needle, armed with a strong double ligature, through the root of the hemorrhoid, and tie one part of this ligature firmly over one side of the swelling, and the other over the opposite side. When the base of the tumour is narrow, and the ligature is preferred, the part may be tied at once, without passing a double ligature through its middle.

Old hemorrhoids, which have been repeatedly in a state of inflammation, at length acquire a considerable degree of hardness. The internal membrane of the rectum becomes thickened, loses its natural softness, and forms a kind of cyst, which prevents the tumour from bursting and bleeding. (See *Theden, Progrès de la Chirurgie*, Sect. 4, p. 73.) In the end, it ulcerates, and pours out a fetid discharge. Its size cannot now be lessened by the use of emollient applications; and its excision is indispensably necessary. (See *Lassus, Pathologie Chir. T. 1*, p. 336.)

An opinion has commonly prevailed, that

the bleeding from piles is of a salutary, or critical nature; an evacuation, by which some peccant, or morbid matter, is thrown off from the body. Hence, many patients have been advised to submit to all the pain and uneasiness which the disease occasions, rather than seek a cure. If the fact that some patients lose their health after their piles have been cured, be received as sufficient proof of the disease having had a salutary effect, the doctrine must remain fully established. But before this inference should be drawn, it ought to be known, whether the frequency of the fact is such as to warrant the conclusion; for it is not to be supposed, that the removal of piles places the patient altogether beyond the reach of disease and illness; and no one will deny, that such operation frequently leads to improvement of the health. Were a patient to appear to suffer from the cessation of an habitual bleeding from piles, fomentations and leeches should be applied.

Consult *L'Encyclopédie Méthodique*; *Partie Chir. Petit, Œuvres Posthumes*, T. 2. *Calvisen, Systema Chirurgiæ Hodiernæ*, T. 2, p.

105, *Edit. 1800. Sabatier, De la Médecine Opératoire*, T. 2. *Latta's System of Surgery*, Vol. 2. *Ware on the Treatment of Hemorrhoids*, Trnka de Krazowitz, *Historia Hemorrhoidum*. 3 Vol. 8vo. Vindob. 1794, 1795. Sir J. Earle, *Obs. on Hemorrhoidal Excrescences*, 2d Ed. 8vo. Lond. 1807. T. Copeland, *Obs. on the Principal Diseases of the Rectum and Anus*, 8vo. Lond. 1814. Schreger, *Chirurgische Versuche*, B. 1, p. 253, &c. *Ueber tuberculöse Excrescenz des Aterdarms*, 8vo. Nürnberg, 1811. John Kirby, *Obs. on the Treatment of certain severe forms of Hemorrhoidal Excrescence*, 8vo. Lond. 1817. Abernethy on Hemorrhoidal Diseases, in his *Surgical Works*, Vol. 2, p. 231, &c. Lassus *Pathologie Chir.* T. 1, p. 331, Ed. 1809. Léveillé, *Nouvelle Doctrine Chir.* T. 3, p. 164. Richter *Von der Blinden Guldnen Ader in Anfangsgr. der Wundarzneykunst*, B. 6, p. 395, Ed. 1802. W. Hey, *Pract. Obs. in Surgery*, p. 439, &c. Ed. 2, 8vo. Lond. 1810. *Dict. des Sciences Med.* T. 20, p. 441; &c. 8vo. Paris, 1817. Montegre, *Des Hemorrhoides, on Traité Analytique de toutes les Affections Hemorrhoidales*, Nouvelle Ed. Paris, 1819.

APPENDIX.

ABDOMEN. Our author in his description of the abdominal cavity, seems to give an incorrect idea of the distribution and connexions of the peritoneum. He would convey, that this substance had within it all the viscera, except the kidneys and contents of the pelvis. Strictly speaking, however, there is nothing within the bag of the peritoneum save a vapour, the secretion of exhalant arteries, which opening upon its inner surface, pour out this fluid to prevent the effects of friction during the motions of the several viscera.

The peritoneum is a membrane, forming a circumscribed cavity, on the outside of which are situated all the viscera; and divided into its visceral and reflected portions. The visceral portion is made up of the back part of this bag, which, after closely enveloping the several viscera, except the kidneys, rectum, and urinary bladder, that are but partially covered, passes toward the posterior abdominal parietes, and there forms the mesentery, mesocolon, and mesorectum, with the broad suspensory and lateral ligaments of the liver, &c. Afterward it becomes attached to the walls of the abdomen, constituting its reflected portion, which becomes a general lining to the whole parietes. Thus, the viscera are all without the peritoneal cavity. We do not consider the abdominal cavity opened, until this bag shall have been cut into; hence, by the cavity of the abdomen, is really meant, the space within the peritoneum; for if a wound had been inflicted upon the abdomen, and the peritoneal lining remained sound, we would not call it a wound of the abdominal cavity. The water of *ascites* is contained within the bag of the peritoneum, and the operation of *paracentesis* or *tapping*, consists in penetrating the cavity of the peritoneum, to allow its escape.

When, however, we speak of the *cavity* of the abdomen, without immediate reference to the bag of the peritoneum, we conceive of it as being a large cavity having certain boundaries containing large and important viscera; and withal lined by the peritoneum. So that there is still an ambiguity in the customary expression, *Abdominal Cavity*, which should be removed, as the student is often led astray, by what appears a contradiction in terms.

ACUPUNCTURE. Notice having
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been taken by some of the journalists of this country, of a work lately issued by Mr. Churchill, of the London College of Surgeons, upon the subject of Acupuncture, it may be expected that I should enlarge a little upon the article in this appendix. This I shall do by a few extracts from that publication.

The subject is introduced, by presenting the manner of performance among the Darien Indians, as related by the Surgeon of Dampier, Mr. Wafer.

The patient is taken to a river, and seated upon a stone in the middle of it. A native, dexterous in the use of the bow, now shoots a number of small arrows into various parts of the body. These arrows are prepared purposely for this operation, and are so constructed that they cannot penetrate beyond the skin, the veins of which, opened by the puncturation, furnish numerous streams of blood, which flow down the body of the patient.

The operation, as practised in Japan, is stated to be as follows.

The place made choice of for the puncture, is commonly at a middle distance between the navel and the pit of the stomach, but often as much nearer to, or farther from, either, as the operator, after a due scrutiny, thinks most proper; and in this, and the judging rightly how deep the needle must be thrust below the skin, so as to reach the seat of the *morbific matter*, and giving it a proper *vent*, consists the main skill of the artist, and the success of the operation is said to depend. Each row hath its particular name, which carries with it a kind of direction with regard to the depth of each puncture and the distance of the holes from each other, which last seldom exceeds half an inch in grown persons, in the perpendicular rows, though something more in those which are made across the body, thus,

The needles which perform the operation, are made, either of the finest gold or silver, and without the least dross or alloy. They must be exquisitely slender, finely polished, and carry a curious point, and with some degree of hardness, which is given by the maker by tempering; and not by any mixture, in order to facilitate their entrance, and penetrating the skin.

But though the country abounds with expert artists, able to make them in the highest perfection, yet none are allowed but such as are licensed by the emperor.

After a further introduction, by recording the opinions and practice of Mr. Berlioz of Paris, and of Dr. Haime of Tours, upon this important operation, Mr. Churchill ventures to exhibit his own experience in regard to acupuncture.

The first case is that of a bricklayer, of thirty years of age, who he describes as truly halt; having come to the house of the Doctor supporting himself with a stick in one hand, and resting the other against the wall.

"The body was bent at nearly right angles with the thighs, and his countenance indicated acute suffering. He had been attacked, he said, three days before with darting, excruciating pains in the loins and hips; every motion of the body produced an acute spasmodic pain, resembling an electric shock; and the attempt to raise the body to an upright position, was attended by such insupportable agony, as obliged him to continue in this state of flexion, rather than encountering it by altering his position. There was no more constitutional disturbance than was to be expected from three days and nights of constant pain; the pulse was a little quickened, and the tongue white, but I attributed this derangement to the irritation set up by the pain and loss of rest. I directed him to place himself across a chair, for support during the operation, and I immediately introduced a needle of an inch and a half in length into the lumbar mass, on the right side of the spine; in two minutes time I observed that he seemed to rest the weight of his body more on his limbs, and in the next instant, without any inquiries being made, he observed that he felt his limbs stronger, from the 'pain having left his hips.' He next plainly indicated that the disease was lessened, by raising his body, from which he only desisted by being desired to remain at rest, through fear of the needle being broken. The instrument having remained in its place for about six minutes, the patient declared that he felt no pain, and could, if he were permitted, raise himself upright; it was then withdrawn; the man arose, adjusted his dress, expressed his astonishment and delight at the sudden removal of the disease, and having made the most grateful acknowledgments, left the house with a facility as though he had never been afflicted."

Another case is one wherein Mr. Churchill succeeded in curing in the same astonishing manner. A young man who had been rendered unable to raise himself, being seized by violent pain in the loins whilst in the act of lifting a very heavy piece

of mahogany. Although two days were devoted to try the effects of cupping and blistering, which had been immediately administered, and which time passed without much relief, yet by the aid of the operation of the acupuncture, the patient was soon rendered fit for his usual employment.—The case is as follows.

"On the third day, the operation of acupuncture was performed upon the part of the loins pointed out as the seat of the injury, which, as in the former case, dissipated the pains in five or six minutes, and restored the motions of the back. He returned, however, the next day with the same symptoms as at first, but in a mitigated degree. A needle was now passed to the depth of an inch on each side of the spine, which, as I expected, terminated the disease in a few minutes; and it was with pleasure that I understood the next morning that the man had gone to his usual employment."

But the Climax!—Mr. Jakes, of Westminster, (the gentleman who is said to have first introduced the operation into England) received an urgent message from Mr. Scott, to visit him immediately. Mr. J. found him in bed, with a countenance expressive of much anguish, having suffered, for three days, from severe pain in the loins, which he attributed to a sudden transition from a warm room to a foggy nocturnal atmosphere.

"Within the last twelve hours it had acquired such a degree of violence, that even respiration was insupportable, except the body were fixed in such positions as permitted the least possible motion. An attempt to resume the erect posture, produced violent spasmodic action of the muscles of the back, which appeared to be communicated by sympathy to those of the abdomen and chest, impeding respiration with a convulsive effort; nor could any motion of the body be made without producing this effect. Neither fever nor general derangement was present, the secreting organs of the body properly performing their functions, proved the external locality of the disease. In this state of things, acupuncture presented itself to us, as likely to afford relief, and it was therefore immediately resorted to.

"I applied an exhausted cupping-glass upon the integuments, opposite the second lumbar vertebra, and midway between this bone and the edge of the latissimus dorsi muscle, which was the part referred to as the most concentrated spot of the disease. As soon as a needle had penetrated to the depth of an inch, a sensation arose, apparently from the point of the instrument, which the patient described as resembling that which is produced by the passage of the electric aura, when directed to a metallic point, diffusing it-

self at first to some distance around the part, and then extending itself to some distance up the side to the axilla. This sensation continued to be felt for the space of a minute, when a violent pain struck into the right iliac region, immediately above, and corresponding with the line of the crista of the ilium. No pain was now felt in the back, except a dull aching of about two inches in breadth on the right side of the spine, extending from the lower part of the neck to the sacrum, corresponding with the situation and course of the longissimus dorsi muscle. The pain above the hip now began to subside, and in the space of *three minutes* from its commencement, had ceased altogether.

"The uneasiness along the course of the spine still remaining, a needle was introduced about an inch from one of the dorsal vertebræ, and another in a corresponding situation, to one of the lower lumbar vertebræ. The pain in the right side was in a few minutes entirely dissipated, and the patient arose, declaring that, excepting a slight degree of uneasiness on the posterior part of the chest, near the angles of the inferior ribs, he was completely relieved from the disease. He, however, *requested* I would pass a needle in this last situation; on effecting which, the pain soon left its last refuge, and the patient dressed himself, and left his house in the most perfect health. I have this day seen him, and he assures me that he has not experienced any return of the affection."

Mr. Churchill's manner of operating is in this wise.

The handle of the needle being held between the thumb and fore-finger, and its point brought into contact with the skin, it is pressed gently, whilst a rotatory motion is given it by the finger and thumb, which gradually insinuates it into the part, and by continuing this rolling, the needle penetrates to any depth, with facility and ease. The operator should now and then stop, to ask if the patient be relieved; and the needle should always be allowed to remain five or six minutes before it is withdrawn. This mode of introducing the needle, neither produces pain (or at least very little,) to the patient, nor is productive of hemorrhage, which Dr. Haime says arises from the fibres being separated, rather than divided by the passing of the needle; the former of which, (the absence of pain) is a point in its favour which few surgical operations possess.

I must say, that I conceive this operation to be an improvement on that of Perkins's celebrated Metallic Tractors, having its beneficial effects upon the same principle.

AMAUROSIS. In the last American edition of this Dictionary, Dr. Dorsey

states, that Dr. Physick has punctured the cornea, and evacuated the aqueous humour in some cases of *gutta serena*, with *temporary advantage*; having been induced to the step from an idea that pressure from an inordinate secretion of the humours might have occasioned the paralysis of the retina. Mr. Ware, in like diseases, also has punctured the sclerotica, as mentioned under the article *gutta serena*, where also it is affirmed, that in several of the cases the proceeding was attended with almost immediate good effect. Now, by a reference to the structure of the globe of the eye, we are enabled to judge of the comparative benefit to be expected from the puncture in each situation.

It is clear, advantage cannot follow such an operation, unless in cases wherein the disease is kept up by pressure upon the filaments of the retina, and which was occasioned by a watery fluid thrown out by the vessels of the choroid coat, among the reticular membrane connecting the retina to its inner surface, in the manner found by Mr. Ware, upon examination of the dead subject. Under such a view of the case, it is obvious, that a puncture into the globe, through the sclerotic coat, would afford opportunity for the escape of this fluid. And as far as it was the cause of the disease, the immediate good effects happening in Mr. Ware's cases would follow, and unless there was a disposition in the parts for its reproduction, which the operation might not overcome, a permanent cure would be accomplished. When, however, in such cases, the puncture is made through the lucid cornea, this watery fluid is not evacuated; the aqueous humour from the eye only escapes. For, in consequence of the connexions of the ciliary processes with the tunic of the lens, a complete partition exists between the chambers of the eye, and the site of the morbid watery accumulation. Nevertheless, by the escape of the aqueous humour, the lens is allowed to be projected somewhat forward against the pupil by the compressed vitreous mass, and until the chambers of the eye become filled again, the retina may be susceptible of impressions from the rays of light, but will soon, on the reproduction of the aqueous humour, be returned to its former state of paralysis:—hence the temporary advantage spoken of in reference to Dr. Physick's cases.

AMPUTATION.

OF LIGATURES FOR THE ARTERIES.

The size and material for ligatures, for the arteries on the face of a stump, will be, in a great measure, regulated by what is the intention of the surgeon. Whether he designs to cut them close to the stump previous to dressing, and at the time

of the operation, or allow their ends to hang from the lips of the wound, to be removed when the arteries which they embrace shall have been divided by ulceration. If the latter is the intention, then it matters little of what substance they are composed; perhaps the common white sewing silk, waxed and flattened, will answer every purpose. But when the surgeon wishes to have a union effected speedily and throughout, by what has been called the first intention, and cuts the threads close to the knot, for the purpose of bringing together the parts over them, then it is expedient that the material of which the ligature is composed, be one which will not act as an offending substance, at the bottom of the wound, and by eliciting the suppurative process, defeat the intention. To forward this end, such ligatures have been recommended, of substances of the nearest ally to animal matter, for the purpose of their more ready absorption; and accordingly, they have been proposed of raw silk, carefully put together and waxed; or of doe skin, of glove leather, or of catgut, &c. If we examine into what must take place from such knots, so shut up in a wound, of whatever material they are composed, we shall be made acquainted how far the practice is to be approved.

All consent, that the ligature around the vessel, effects adhesion of its sides, by the pressure it makes upon the tube at that part; and, as applied in amputation, this is so great, that the ulcerative process supervenes, and is carried on until the artery is rid of this now offending substance. This process of ulceration is accompanied with a free supply of pus, in which the ligature lies until it is removed. If the ends of the ligature have been cut off close to the knot, at the time of the operation, the process just spoken of will nevertheless have gone on thus far. Matter will now continue to be thrown out, in quantity proportionate to the power of the substance composing the ligature to cause irritation, and to the time required for its complete solution; for the ligature must be dissolved before it can be absorbed, and the excess of pus required for its solution, must be absorbed also before the stump can be pronounced healed; and it is still a query, whether, notwithstanding how rapidly all this may have been accomplished, it can be called a healing by the first intention. More frequently, however, the pus in such a case is found to disturb the newly cicatrized integuments,* and be the cause of one or more troublesome little abscesses

on the face of the stump, either in the course of the cicatrix or through the skin at other parts, (for I have seen them in both situations,) that may be referred to unauthorized attempts, on the part of the surgeon, to produce a too speedy union after amputation.

Mr. Lawrence, in favour of this practice, has recommended very small and thin ligatures, of what is called *dentist silk*; but the inconveniency and trouble which must attend the tying of a large vessel with such small thread, must, in my opinion, overbalance any advantage that may have been attributed to the measure; besides, the same process of solution, previous to absorption, must take place in these cases; so that even here we cannot have an absolute union by the first intention.

In the last instance I witnessed this practice, the ligatures were made of doe skin, and cut off close to the knot, in amputation below the knee. At the end of a week, a most alarming secondary hemorrhage took place, which nearly carried off the patient, having been with much difficulty arrested. This I immediately attributed to the circumstance of thus disposing of the ligatures, and the surgeon who operated was so convinced of the force of the remark, that he resolved never to deal in the practice again.

I can imagine that when the knots are made by small thread or silk, they may become encysted, after the manner of some foreign bodies in wounds, and soon cease to be offending causes, but this must be a rare occurrence in comparison to the other issue. Upon the whole, I think, that the method of cutting off one end of the thread close to the knot, and letting the other pass beyond the lips of integument, opposite the vessels to which they are applied, and so distributing the adhesive straps at the dressing as to allow such accommodation, is a practice that cannot be improved upon.

OF DRESSING THE STUMP.

I have the pleasure to record an important feature in the practice of American surgery, which is a very effectual preventive of secondary hemorrhage, after the operation of amputation. I allude to a delay in dressing the stump, from half an hour to an hour after the ligatures are applied. During this time the patient is put to bed, the paraphernalia of the operation removed, and every ordinary means afforded for the reaction of the system, after the effects of fear, loss of blood, &c. By this plan, those small vessels which might have bled, without discovery, had the wound been immediately dressed, will show themselves, and the surgeon will have an opportunity of securing them by ligature, before the plasters and bandages are applied. He will be

* It is found, that the process for dissolving the ligature, does not retard the entire union of the integuments of the stump, by the first intention; if it did, there might be, perhaps, less danger in trying these experiments.

able, also, to remove all the clotted blood, derived from an oozing from the capillaries; and in this way, give facility for adhesion by the first intention. I am confident, that most of the cases of secondary hemorrhage, after amputation, which I have seen, and they were many during the late war, might have been prevented by this precaution. And I feel assured, that most of those instances that were attended with extensive suppuration and delay, nay, sometimes followed by convulsions and death, are to be attributed to irritation, kept up by the presence of blood, which had oozed from the small vessels, succeeding a too early dressing after the operation. I have to state, that I first witnessed this excellent caution in the practice of Dr. Parish, of Philadelphia.

In regard to the direction of the line, made by bringing together the common integuments over the face of the stump, I believe it altogether unimportant what is the course given to the cicatrix, as to the ultimate shape of the stump. What is called a *good* and *handsome* stump, is not derived, in my opinion, from attention to this particular; but from the circumstance of preserving sufficient integument to cover the muscles and bone. I also think, that if the flap operations had nothing else to recommend them than making a well-shaped stump, it would be better the practice was laid aside. I believe there is little danger to be dreaded from leaving too much integument for this purpose, but that there is every thing to be feared from leaving too little. In amputations below the knee, however, it may be of consequence to bring the integuments together in a particular manner; but then there is a different motive that directs the indication, than that of giving shape to the stump. It is expedient that this stump should be covered in a way that the bones may be least likely to make an injurious pressure against the skin; and for this end, the union of integument should be directed downward and outward, which is in conformity to the line made by the ends of the divided bones, in relation to each other; for we have many times seen the end of the tibia find its way through the ulcerated integuments, in a different situation than where they were divided at the time of the operation. It may be recollected likewise, that this line will be in a perpendicular direction, when the limb is placed on its side in bed, as effected by separating it from the other, and putting pillows under the outside of the thigh; by this also a ready outlet is afforded for pus, as it may be formed during the cure.

FLAP OPERATIONS.

The many objections that are now con-

firmed against the great variety of flap operations, and that have been opposed to amputation by the circular incision, have, I believe, pretty well succeeded in making the latter the general practice at the present day. The greater extent of wounded surface, the oblique division of blood-vessels, the difficulties experienced while searching for arteries in secondary hemorrhage, not being the least among the objections that have prevailed against flap operations in amputation. I have, however, witnessed, in Philadelphia, what might perhaps bear the name of a flap operation, by Drs. Parish and J. R. Barton, which for aught I know, is original with them; and from not being subject to the weighty objections to flap operations generally, I think, upon the whole, to be advised in all cases where it is practicable, in amputations below the knee. The manner of the performance is as follows.

The surgeon, in making the first incision, does not carry it circularly round the limb, but gives it an oblique direction, so that the incision round the limb is of an oval shape; the lesser diameter of which is from side to side, and the place where the integuments are cut on the forepart of the leg, is much higher than where they are divided behind. The whole of this incision is done by one sweep of the knife, and perhaps is not giving more pain in its performance to the patient, than that through the skin in the circular direction. The integument is then dissected back at the front of the limb, from the forepart of the tibia for about half an inch, and for a considerable extent behind, to prepare for the second incision, or that through the muscles, which is made in a circular direction, after the manner of the second cut in the operation by the triple incision. The rest of the performances is gone through as in the old way. The benefit of this method is ascribed to the neat manner in which the face of the stump can be covered, by bringing forward the flap of skin which had been left at the back part of the leg. In this case, also, the line by which the integuments are brought together, will be somewhat perpendicular when the limb is placed in bed, with the outside of the thigh against a pillow.

SHOULDER JOINT OPERATION.

In reference to amputation at the shoulder joint, I shall not presume to add much, but when parts will permit, it is undoubtedly the best method to amputate by making a flap of the deltoid muscle. The excellent covering afforded to the glenoid cavity, the permanent fleshy padding over the bone, are advantages which I would value above any derived from the other methods. Another benefit which I believe will accrue from this me-

thod, is, that the stump will be by it more likely to heal by the adhesive process. There is in these cases a strong exciting cause to suppurative inflammation, which I will undertake to say is owing to the presence of the cartilaginous covering, or lining of the glenoid cavity. Hence, it has been recommended to scrape the glenoid cavity, as a necessary step to this operation, although Mr. Cooper thinks the advice of little value, except when it is under disease. From the particular structure of interarticular cartilages, they will not granulate, and are insusceptible of the adhesive inflammation, but are to be removed through a process of absorption, effected by the inflammation of the surrounding parts. It is their presence which makes wounds of joints so dangerous, from the irritation they afford to the constitution, through the medium of a highly susceptible synovial membrane. There was lately a case in this city, which was not well in twelve months after the operation; and from the information I collected respecting it, I believe that the omission of scraping the cartilage from the glenoid cavity, was not the least among the causes that did protract the cure.

I cannot imagine any case wherein an amputation of the shoulder joint might be deemed advisable, that it would be necessary or proper to secure the subclavian artery, by ligature, previously to the performance of the operation. The situation of the subclavian artery, where it lies upon the first rib, just above the middle of the clavicle, is peculiarly convenient for pressing the vessel, either by the thumb, or a pad, easily contrived on the handle of a key, &c. if the surgeon should not choose to secure it first in the axilla, or if the state of the disease prevented him.

AMPUTATION OF THE THUMB.

When it is necessary to remove with the thumb the metacarpal bone, a very pretty operation can be performed in this manner. An incision is to be begun up the inner part of the hand, opposite the os trapezium, and carried on each side of the metacarpal bone of the thumb, in shape of letter V. These two lines are to meet under the root of the thumb, at the junction of the first phalanx with the metacarpal bone. The bone is then to be separated from the trapezium, and with the whole thumb to be taken away. The adductor muscles and fleshy belly of flexor pollicis brevis, form a fine cushion, so that when the parts are brought together, any great loss of substance will not be perceived.

ANASTOMOSIS. Under this head, might with propriety be introduced the result of the several *post-mortem* examina-

tions, instituted for the purpose of discovering the route of the circulation of the blood, in cases wherein some of the principal arteries had been tied, for the cure of aneurism, as well as from diseased obstructions. A knowledge of the dilatable power of the arteries, however, is now so well confirmed, that the record at this time might be considered more a matter of curiosity than for direction to the surgeon, as to what arteries he might attempt to tie. For since the human subject has undergone the sudden interruption in the course of the blood, through the aorta, by an operation by Sir Astley Cooper, and through the arteria innominata, by one performed by Professor Mott, without exhibiting any unpleasant symptom from the circumstance of the sudden suspension of the natural course of the blood. No surgeon need now hesitate, on this account, in tying these or lesser arteries. As the *post-mortem* appearances, however, in the case in which the carotid artery was tied by Professor Mott, previously to extirpating a large tumour from the side of the neck, has not been recorded by the author of this Dictionary, I shall extend this article, by giving it a place.

John M'Garrigle, born in Ireland, aged forty-nine years, was admitted into the New-York Hospital, on the 10th of November, 1818, with a carcinomatous fungus, situated on the right side of the face and neck, occupying a considerable portion of each. From its highly vascular appearance, as well as other reasons, it was, in a consultation of the surgeons of the Hospital, agreed, that an operation, which would lessen the flow of blood to the fungus, and permit as much of the tumour to be removed as possible, would afford the only possible means of prolonging the patient's life, and of mitigating his sufferings. With these views, on the 14th of the same month, the right carotid was taken up, about an inch below the cricoid cartilage, and secured by two ligatures, but not divided in the interspace, in consequence of the depth of the artery, occasioned by the swelling of all the parts surrounding the disease. And such was the enlarged size of the vessels, that it became necessary to take up several arteries and veins before the carotid could be exposed. The tumour was now removed in a manner detailed in the second number of the Register of Medical and Surgical Cases in the New-York Hospital, which can be referred to; suffice it to say, that the operation was completely successful, but he died from a pulmonary disease on the following March 3d, having been greatly emaciated and worn out by a succession of hectic symptoms.

By this, an opportunity was afforded for an examination into the new route

the blood had taken, succeeded to the obliteration of the carotid artery, and having seen the preparation, and compared it with the description by Dr. Mott, in the Hospital Register, I shall give the detail of the dissection, as it is there delineated.

"As this afforded me an excellent opportunity of examining the arteries on the right side of the head and neck, after the carotid had been tied, and not knowing that any such case had been recorded, I gladly availed myself of it, and separated the head, neck, and shoulders in the following manner.

Having sawed through the sternum at the upper part, so as to leave the clavicles attached, the superior extremities were removed from the trunk, and the dorsal vertebræ and ribs divided between the second and third, so as to leave it of a bust-like shape. This preserved the shoulders in such a way, that the subclavians and their branches might be injected. The ascending arch, and a portion of the descending aorta, were also included in the preparation.

To secure the filling of the arteries of the head and neck, a long pipe was passed up the aorta, into the left carotid, and a fine wax injection was thrown in with great care, and as the subsequent account will show, with great success. The aorta was next injected, to fill the subclavians and their branches. In the dissection, which was conducted with the greatest care and attention, I was assisted by David L. Rodgers and Alexander Vaschè, two of my pupils, ardent in the pursuit of anatomical and surgical knowledge.

1st. The arteries that supplied the right side of the head and neck, after the carotid had been tied.

To give a regular description of these arteries, would be incompatible with the principle of collateral circulation, inasmuch as they are found to vary in different subjects, for, "the circulation is never carried on by any particular set of vessels, but by all the arteries of the neighbouring parts."

Upon removing the integuments on the forepart of the neck, and laying bare the carotid artery, from the innominate to the angle of the jaw, its calibre was found completely obliterated from its origin to its bifurcation; leaving a firm, ligamentous chord, which was divided into two parts, showing the place where the ligatures had been applied.

The vein and nerve were perfectly natural. The right subclavian was much enlarged, being equal in size to the innominate, from its origin to the scaleni muscles.

The left carotid was enlarged to twice its natural diameter, its branches increased

in the same ratio, and assumed a tortuous and irregular course.

When we take into consideration the connexion which the arteries of the left have with those of the right side of the head, and their free inosculation with the subclavian, we can have in our imagination the branches that must necessarily supply the place of the right carotid. First, we have the branches arising from the subclavian, which are very numerous; secondly, those arising from the left carotid, which are still more numerous.

A minute detail of the numerous vessels which communicate with the carotid, would be tedious and uninteresting, and would, perhaps, be impracticable, were it deemed expedient. Suffice it to notice the principal branches, and to give a general description of the smaller, but not less beautiful inosculation. We find them arising from the right subclavian; first, the arteria thyroidea inferior, secondly, the cervicalis profunda, thirdly, the cervicalis superficialis, and fourthly, the vertebral arteries.

The inferior thyroid, as it arises from the subclavian, divides into four branches; two passing downwards and outwards, and the other two passing upwards; the latter are called the ramus thyroideus and the thyroidea ascendens. These require particular attention from their large size, and the important supply of blood which they furnish for the support of the arteries of the neck. While the superior arteries are enlarged to twice their natural diameter, the two inferior ones, viz. the transversalis colli, and the transversalis humeri, although arising from the same trunk, and receiving their currents of blood in the most favourable direction, still retained their natural dimensions. But this phenomenon usually occurs in the circulating system. John Bell observes, "that in whatever way the demand of blood, upon an artery, or set of arteries, is increased, the effect is an accelerated motion of blood towards that artery." And again, "any demand of blood causes an enlargement of the arteries, leading to the part which demands the blood."

Guided, then, by this principle, we need not be surprised, that the subclavian is so much enlarged from its origin to the scaleni muscles, for here it affords a supply of blood to new and important parts. The ramus thyroideus passing upwards to the thyroid gland, and anastomosing with the superior thyroidal artery, was one great source of blood, its branches were large and tortuous, forming communications in every direction, with those from above.

The thyroidea ascendens, naturally a small and unimportant branch; it was here three times its usual size, mounting

up the neck in a zigzag direction, lying close to the vertebræ, forming frequent communications with the vertebral artery, dividing into many small branches at the upper part of the mastoid muscles, forming a beautiful plexus of vessels, with the mastoid branch of the occipital artery, and sending branches to all the muscles on the upper part of the neck.

The *cervicalis profunda* and *superficialis*, were much enlarged, sending frequent branches upwards to anastomose, with the descending branches of the occipital artery. By far the most important and interesting part of the circulation yet remains to be described.

2dly. *The arteries of the left side of the head and neck.*

The left carotid, passing up the neck, equal in size to the *arteria innominata*, furnished the greatest part of the blood for the right side.

In order to determine what particular arteries were enlarged, it is necessary only to enumerate the branches given off from the carotid, and more particularly those which arise from its forepart. Below the jaw there are four, to wit, the superior thyroid, the lingual, pharyngeal, and the *maxillaris interna*, which inosculate with open mouths, having the appearance of continuous trunks, and sending a plentiful supply of blood to the neck, and internal parts of the face.

The labial and temporal arteries leaving the axilla under the angle of the jaw, passing upwards upon the face, send off small branches in a beautiful and fantastic manner. Branches, which before were considered unworthy the attention of the anatomist, now rise into importance. The plexuses and inosculations formed by these branches excite alike our surprise and admiration, and elucidate, in the most beautiful manner, the principles of collateral circulation. These arteries in general are large and tortuous, and have frequent communications among themselves. The arteries most enlarged, were the mental, the inferior labial, the coronary, and the angularis. The optic artery was likewise much enlarged, beautifully anastomosing with the angularis.

So freely did these arteries inosculate with those of the right side, that before the operation was finished, it was found necessary to secure the labial artery in a ligature. This was clearly illustrated by the retrograde course of the injection, after death, which passed freely from the arteries of the opposite side, filling the superior portion of the labial, to the point at which the ligature had been applied. The temporal artery was of its natural size, receiving its blood from "all the arteries of the neighbouring parts, from the ascending branches of the occipital, the

left temporal, the ophthalmic, and the transverse facial. This free communication was distinctly shown by injection, which passing down the temporal, completely filled the external and internal carotids, and several of their branches; particularly the inferior portion of the labial, which is seen emerging from under the jaw to pass upon the face. The labial terminated at that point, where the mental is given off. The mental itself passed on to its usual destination, and received blood from its fellow from the opposite side."

ANEURISM. I was not a little surprised, when, upon a close inspection of this edition of the Dictionary, I found that the author had altogether omitted the case in which the *arteria innominata* was tied, in this country, for the purpose of diverting the blood from an aneurismal cyst, which occupied the subclavian artery. This case having been on record sufficiently early, must have met the industrious eye of Mr. Samuel Cooper, but I cannot account why its detail, or a bare mention of it had been neglected. I am aware, however, that the critics of this country did, in a great measure, succeed in establishing, for a time, an unbelief in what had been alleged by the operator: having presumed to assert, that the operation was unauthorized; that the disease which was said to call it forth, was not an aneurism of the subclavian artery; and that the method adopted to get at the artery, was attended with an unnecessary violence to the surrounding parts, from which it was probable that the patient lost his life.

Having seen the preparation, and carefully examined into the history of the case, it does appear to me, that malevolence had dictated for the critics, and jealousy prescribed for the reviewers. But truth will be established and must out, although for a time its influence may be suspended by the ephemeral effects of ignorance, impudence, and folly.

If the limits of this Appendix had permitted, it was my intention to present a general examination into the merits of this very important and singular operation; but I must content myself by merely offering the case, and subjoining a reference to the several reviews; by which may be seen the motives of those who have declaimed against it, all which, with an appeal to the reader's own knowledge of the anatomy of the part, I feel assured will be sufficient to substantiate, that the disease was an aneurism of the right subclavian artery, that the *arteria innominata* had a ligature placed around it in the most apt manner, by Professor Mott, and that although the patient died on the 26th day after the operation, yet that his death was not the necessary consequence of its performance.

I shall transcribe Dr. Mott's communi-

cation, from the New-York Hospital Reports.

"Since the publication of Allan Burns's invaluable work on the Surgical Anatomy of the Head and Neck, I have been in the habit of showing in my surgical lectures the practicability of securing in a ligature the arteria innominata; and I have had no hesitation in remarking that it was my opinion, that this artery might be taken up for some condition of aneurisms; and that a surgeon, with a steady hand and a correct knowledge of the parts, would be justified in doing it. I felt myself warranted in this, from the singular success which this celebrated anatomist informs us attended his injections, and from my own investigations of this subject. If the right arm, right side of the head and neck, can be filled with injection, after interrupting its passage through the innominata, as we believe they can, who can doubt the possibility of the blood to find its way there also, as it will pass through thousands of channels, which art could not penetrate even by the finest injections? The well-known anastomoses of arteries, and the great resources of the system in cases of aneurism, encouraged me to believe, that this operation might be performed with reasonable prospects of success. With all this sanction, and the analogy of the other great operations for aneurism, I could not for a moment hesitate in recommending and performing the operation.

"The following operation, as the steps of it will show, was performed with the two-fold intention: 1st, of tying the subclavian artery before it passes through the scaleni muscles, if it should be found in a fit state; and 2dly, to tie the arteria innominata in case the former should be diseased or too much encroached upon by the aneurismal tumour.

"Michael Bateman, aged 57 years, was born in Salem, Massachusetts, and by occupation a seaman. He was admitted into the New-York Hospital on the 1st of March, 1818, for a catarrhal affection, having at the same time his right arm and shoulder much swollen." At the time of his admission the catarrh being thought the most considerable disease of the two, he was received as a medical patient, and placed under the care of the physician then in attendance. During the three first weeks of his residence in the house, the catarrh had greatly yielded to the remedies prescribed. The inflammation, which had produced an enlargement of the whole superior extremity, extending itself to the muscles of the neck on the right side, was also gradually subsiding.

"A tumefaction, however, situated above and posterior to the clavicle, at first involved in the general swelling, and not to be distinguished from it, began to show

itself. This resisted the remedies which were effectual in relieving the other, and became more distinct and circumscribed as the latter subsided; at length assuming the form of an irregular tumour.

"The history which he gave of the case is as follows: He said, about a week before he entered the hospital, while at work on ship-board, his feet accidentally slipped from under him, and he fell upon his right arm, shoulder, and the back part of his head; that he felt but little inconvenience from the fall, and after a short time returned to his duty. Two days subsequent to this, however, he felt pain in the shoulder, and the succeeding night was unable to lie upon it in bed. The whole arm and shoulder then began to swell, and became so painful that he was unable any longer to perform his duty as a seaman. The ship having arrived in New-York, he was admitted into the hospital.

"For some time after the general swelling had subsided, leaving the tumour distinct and circumscribed, no circumstance occurred which gave rise to a suspicion of its being aneurismal. The enlargement was thought to be a common indolent tumour, and was repeatedly blistered, with a view to discuss it. The tumour gradually diminished under this treatment; though a considerable time elapsed before any very striking change took place.

"At length a faint and obscure pulsation was perceived; still it was a matter of doubt whether the tumour was aneurismal, or whether the pulsatory motion was communicated to it by the subclavian artery, immediately over which it was situated. From its firm unyielding nature upon pressure, the latter was considered as the most probable, and the blisters were continued as before. During the whole of this time the patient had worn his arm in a sling, the motions of it being very limited, and always attended with pain.

"The patient remained in this state for several days, without any marked change either in his feelings or in the appearance of the tumour.

"On the 3d of May, at 6 o'clock in the afternoon, the patient complained that he "felt something give way in the tumour,"* that his shoulder was very painful, and that he was able to raise it only a few inches from his side. The tumour at this time suddenly increased about one-third, and a pulsation was distinctly perceptible. Its most prominent part was below the clavicle; at which place the pulsation was most distinct. The portion above the clavicle was also much enlarged; it still,

* In the preparation, the clavicle is to be seen divided about its middle, which from its appearance is shown to have been effected by absorption. This Dr. M. seems to have omitted to mention.

however, had its usual firmness, except in one point near its centre.

"May 4th.—The tumour is evidently increased, that portion of it more particularly which is below the clavicle; it is not as firm and resisting as it has been. Pulsation is not so distinct as yesterday, but appears to be more diffused.

"He was this day transferred to the surgical side of the house, and became my patient. The cough having become comparatively slight, the tumour appeared to be the most urgent disease, and, in my opinion, to call for prompt attention. The arm is now perfectly useless, and any motion at the shoulder joint gives him severe pain. The patient is naturally of a spare habit, and from the nature of his disease, and the confinement to which he has been subjected, has become much reduced in strength.

"May 5th and 6th.—The tumour is still progressing, and the pain in the shoulder is also more severe. During the three last days his medicines have been discontinued, except that he is allowed to rub the parts about the clavicle with volatile liniment.

"On the 7th I directed a consultation of my colleagues to be called, consisting of Drs Post, Kissam, and Stevens. I now stated to them that I wished to perform an operation which would enable me to pass a ligature around the subclavian artery, before it passes through the scaleni muscles, or the arteria innominata, if the size of the tumour should prevent the accomplishment of the former. This I was permitted to do, provided the patient should assent, after a candid and fair representation was made to him of the probable termination of his disease; and that the operation, though uncertain, gave him some chance, and, as we thought, the only one of his life.

"Dr. Post, at my request, communicated with him privately on this subject, and after a full explanation of the nature of the case, my patient requested to have any operation performed which promised him a chance for his life, saying that in his present state he was truly wretched.

"May 8th, 9th, and 10th.—The tumour is acknowledged by all to be increasing, and it is thought proper not to defer the operation any longer. I therefore requested that preparation be made for performing it to-morrow.

"It is difficult to give an idea of the size of a tumour so irregular in its form, and so peculiarly situated. A thread passed over it, from the lower part of that portion of it which is below the clavicle, extending upward obliquely across the clavicle toward the back of the neck, will measure five and a quarter inches. Another crossing this at right angles one inch above the clavicle, will measure four inches; two and a half inches of the thread

are on the sternal side of the former, and one and a half on the acromial. It rises fully an inch above the clavicle, which, added to the depression below the clavicle on the opposite shoulder, will make the size of the swelling above the natural surface about two inches.

"May 11th.—One hour before the time assigned for the operation, the patient appeared perfectly composed, and apparently pleased with the idea that the operation afforded him a prospect of some relief. He was directed to take of Tinct. Opii. 70 drops.

"No difference can be perceived in the pulsation of the arteries in the two extremities; his pulses are uniform and regular, each beating 69 in a minute.

"He was placed upon a table of the ordinary height, in a recumbent posture, a little inclining to the left side, so that the light fell obliquely upon the upper part of the thorax and neck. Seating myself on a bench of a convenient height, I commenced my incision upon the tumour, just above the clavicle, and carried it close to this bone and the upper end of the sternum, and terminated it immediately over the trachea; making it in extent about three inches. Another incision about the same length, extended from the termination of the first along the inner edge of the sterno cleido mastoid muscle. The integuments were then dissected from the platisma myoides, beginning at the lower angle of the incisions, and turned over upon the tumour and side of the neck.

"Cutting through the platisma myoides, I cautiously divided the sternal part of the mastoid muscle, in the direction of the first incision, and as much of the clavicular portion as the size of the swelling would permit, and reflected it over upon the tumour. The internal jugular vein was encroached upon by the swelling, which made this part of the operation of the utmost delicacy, from the morbid adhesion of that part of the clavicular portion of the muscle to it, which was detached. I separated this portion of the muscle to as great an extent, however, as the case would possibly allow, to make room for the subsequent steps of the operation; only a part of the vein was exposed. The sterno hyoid muscle was next divided, and then the sterno thyroid, and turned upon the opposite side of the wound, over the trachea. This exposed the sheath containing the carotid artery, par vagum, and internal jugular vein. A little above the sternum, I exposed the carotid artery, and separated the par vagum from it; then drawing the nerve and vein to the outside, and the artery towards the trachea, I readily laid bare the subclavian about half an inch from its origin. In doing this, the handle of a scalpel was principally used, nothing

more being required but to separate the cellular membrane, as it covers the artery. I judged it would be very imprudent to introduce a common scalpel into so narrow and deep a wound, especially as it would be placed between two such important vessels or parts, as the carotid and par vagum, and where the least motion of the patient might cause a wound of one or the other of them. The proper instrument, in my opinion, for this part of the operation, is a knife, the size of a small scalpel, with a rounded point, and cutting only at the extremity; this was used, and found to be very convenient for this stage of the operation. It can be introduced into a deep and narrow wound, among important parts, without the hazard of dividing any but such as are intended to be cut. This knife is contained in a set of instruments admirably calculated for this and other operations on arteries deeply seated, and which I shall mention more particularly hereafter.

"On arriving at the subclavian artery, it appeared to be considerably larger than common, and of an unhealthy colour; and when I exposed it to the extent of about half an inch from its origin, which was all that the tumour would permit, to ascertain this circumstance more satisfactorily, my friends concurred with me in opinion that it would be highly injudicious to pass a ligature around it. The close contiguity of the tumour would of itself have been a sufficient objection to the application of the ligature in this situation, independent of the apparently altered state of the artery. Art in this case could not anticipate any thing like the institution of the healthy process of adhesive inflammation in an artery in the immediate vicinity of so much disease. The Pathology of arteries has long since taught us, that ulcerative inflammation, and all its train of consequences, would have been the inevitable result. This was the fate of the only case, in which a ligature has been applied to the artery in this situation. The operation was performed by that eminent Surgeon of Dublin, Dr. Colles.

"While separating the cellular substance from the lower surface of the artery, with the smooth handle of an ivory scalpel, a branch of artery was lacerated, which yielded for a few minutes a very smart hemorrhage, so as to fill the wound perhaps six or eight times. It was about half an inch distant from the *innominata*, and from the stream emitted, was about the size of a crow-quill. It stopped with a little pressure. I can scarcely believe this to have been the internal mammary, from the hemorrhage ceasing so quickly; though, from its situation, it would appear so; and if from some irregularity it were not the superior intercostal, it must

have proceeded from an anomalous branch.

"With this appearance of disease in the subclavian artery, it only remained for me either to pass the ligature around the *arteria innominata*, or abandon my patient. Although I very well knew, that this artery had never been taken up for any condition of aneurisms, or ever performed as a surgical operation, yet with the approbation of my friends, and reposing great confidence in the resources of the system, when aided by the noblest efforts of scientific surgery, I resolved upon the operation.

"The bifurcation of the *innominata* being now in view, it only remained to prosecute the dissection a little lower behind the sternum. This was done mostly with the round-edged knife, taking care to keep directly over and along the upper surface of the artery. After fairly denuding the artery upon its upper surface, I very cautiously, with the handle of a scalpel, separated the cellular substance from the sides of it, so as to avoid wounding the pleura. A round silken ligature was now readily passed around it, and the artery was tied about half an inch below the bifurcation. The recurrent and phrenic nerves were not disturbed in this part of the operation.

"As most surgeons who have performed operations upon large arteries, in deep and narrow wounds, complain of the embarrassment which has attended the application of the ligature, I am happy in the present opportunity to have it in my power to recommend an instrument, or contrivance, which, in my opinion, is calculated to surmount all difficulties. This set of instruments consists of several needles of different sizes and curvatures, with sharp and blunt points, and having in each two eyes. The needles screw into a strong handle or shank of steel: two strong instruments in handles, with a ring or eye in the extremity similar to a tonsil iron, and perhaps they may be called ligature irons: a small knife rounded at the extremity like a lancet for scarifying the eyes, and a small hook at the extremity of a steel shank, also fixed in a strong handle. These instruments are the invention of Drs. Parish, Hartshorne, and Hewson, of Philadelphia. They are the result of investigations made upon the dead body, as to the best mode and place for tying the subclavian artery on the *acromial side of the scaleni muscles*.*

"With the ligature introduced into the eye of one of the smallest blunt needles, which was nearest the shank of the instrument, I pressed down the cellular substance and pleura with the convex part, and very carefully insinuated it from

* See Dr. Parish's Paper, *Eclectic Rep.* vol. iii. p. 229.

below upwards, under the artery. The point of the needle appearing on the opposite side of the artery, I introduced the hook into the other eye of it; then unscrewing the shank, the needle was drawn through with the utmost facility, leaving the ligature underneath the artery.

"In the application of the ligature to this artery, I would invite the attention of those who perform it, to a circumstance which, in my opinion, is somewhat important: it is to pass the ligature from below upwards, in order to prevent the pleura from being wounded. From the use of these instruments repeatedly, I would also recommend that the hook be fixed in the eye of the needle before the shank is unscrewed, otherwise very considerable difficulty will be experienced in finding it, and even when felt, not easily introduced, from the want of firmness which the handle part of the instrument would afford.

"I now made a knot in the ligature, and with my forefingers carried it down to the artery, and drew it a little so as partly to close its diameter and arrest the column of blood gradually. This was continued for a few seconds to observe the effect produced upon the heart and lungs; when no change taking place, it was drawn so as to stop the circulation entirely, as was shown by the radial artery of the right arm, and the right temporal immediately ceasing to pulsate. The knot was drawn more firmly by the ligature irons, and a second knot applied in the same manner.

"In no instance did I ever view the countenance of man with more fluctuations of hope and fear, than in drawing the ligature upon this artery. To intercept suddenly one-fourth of the quantity of blood, so near to the heart, without producing some unpleasant effect, no surgeon, *a priori*, would have believed possible. I therefore drew the ligature gradually, and with my eyes fixed upon his face, I was determined to remove it instantly if any alarming symptoms had appeared. But, instead of this, when he showed no change of feature or agitation of body, my gratification was of the highest kind.

"Dr. Post now asked him if he felt any unpleasant sensation about his head, breast, or arm, or felt any way different from common, to which he replied, that he did not.

"Immediately after the ligature was drawn tight, the tumour was reduced in size about one-third, and the course of the clavicle could be distinctly felt.

"The parts were now brought into coaptation, and the integuments drawn together by three interrupted sutures and straps of adhesive plaster; a little lint and additional straps completed the dress-

ing. Three small arteries were tied in the course of the operation: the first was under the sternum, and divided with the sternal part of the mastoid muscle, and from its course may have been a branch of the internal mammary reflected upwards; the second, in raising the inner edge of the mastoid muscle, about the upper angle of the longitudinal incision, and must have been the most descending branch of the superior thyroid; and the third was a branch of the inferior thyroid, and cut while raising the sterno thyroid muscle. The patient lost perhaps from two to four ounces of blood, most of which came from the ruptured branch of the subclavian. The operation occupied about one hour.

"The curved spatulas recommended by Dr. Colles, I found of great use in the operation. I provided three for this purpose, two broad, and one narrow, bent at right angles, and sufficiently firm. After raising the muscles, they were of the greatest advantage in keeping separated the carotid artery and par vagum, as likewise the divided muscles; they served also another very useful purpose, that of preventing by their equable pressure the constant oozing from the smaller vessels; and the little room taken up in a small and deep wound, will give them a great superiority over the fingers introduced.

"Ten minutes after the operation the pulse is regular, and not the least variation can be perceived; it beats 69 strokes in a minute; the patient says he is perfectly comfortable, and has no new or unnatural sensation, except a little stiffness of the muscles of the neck, which he thinks is owing to the position in which his head was placed during the operation; the temperature of the right arm is a little cooler than the left; his breathing has not been the least affected by the operation, but is perfectly free and natural.

"2 o'clock, P. M.—Patient expresses a desire to eat, and is directed a little thin soup and bread; the temperature of both arms is very nearly the same; breathing perfectly natural; pulse as before.

"3 o'clock, P. M.—There is still a trifling difference in the temperature of the two arms; ordered the right to be wrapped in cotton wadding; not the least unpleasant symptom has as yet made its appearance.

"6 o'clock, P. M.—Complains of a little pain in his head, not more on one side however than the other; describes it as a common headach: the pain of the shoulder and arm much less than before the operation: no difference can now be perceived in the temperature of the two arms; pulse a little accelerated, and perhaps a little full.

"9 P. M.—Patient complains of headach; skin is rather hotter than natural;

pulse strong and full, and beats 75 in a minute; the carotid on the left side of the neck is observed to be much dilated and in strong action; tongue moist and clean.

"9 1-2 P. M.—Symptoms continuing the same, directed him to be bled from the left arm to $\mathfrak{z}\text{xvj}$. After bleeding the pulse fell 7 beats, and was less full. Complains of some thirst; let him drink common tea.

12 P. M.—Patient has slept a little; is free from pain; pulse full and less frequent, beats 60; skin moist and of a natural temperature.

"Second day, 2 o'clock A. M.—Patient enjoys a natural and undisturbed sleep; respiration free, and performed without the least difficulty.

"5 A. M.—He has rested well the last three hours. Says he has a slight headache, and a little pain in the right elbow: the latter he attributes to the position in which his arm has lain during sleep; pulse full, but not so tense as before the venesection; skin natural and moist; temperature of both arms the same. He states that he can now incline more upon the right shoulder than he has been able to do since the second day after he received the injury.

"9 A. M.—Pain in the head no way troublesome; skin moist and of natural temperature; tongue clean; says his neck feels stiff, but is not painful; has no difficulty in swallowing. His cough has thus far been much less frequent than before the operation: expectoration is also attended with less difficulty; pulse 75, full, but not tense; has taken a dish of coffee, and some bread; complains of some thirst; directed a solution of super-tartrate of potass to be drank occasionally.

"10 A. M.—Symptoms as before; the veins of the fore-arm and hand since the operation have been as much distended as previous to it, and upon compressing them so as to stop the circulation, and allow the vein to become empty for some distance above, the column of blood is seen to distend the vein immediately upon the removal of the pressure, plainly showing that the circulation is going on with considerable rapidity, although no pulsation has been felt in the brachial or radial arteries. The radial artery can be easily distinguished by the fingers, and seems to be filled with blood. There is evidently a pulsation in the anterior branch of the temporal artery, just as it is passing a little above the exterior canthus of the orbit; the left external carotid is beating with increased action, and appears larger than natural.

"3 P. M.—Has taken a light dinner, and complains of a little headache; pulse has become tense, and is also increased in frequency; skin is considerably hotter

than natural; tongue too indicates a febrile action: was bled to $\mathfrak{z}\text{viij}$. and directed to drink freely of a solution of the super-tartrate of potass.

"10 P. M.—Since the last report he has become more comfortable; complains of no pain, and says he lies perfectly easy; pulse increased in frequency to 78, but of the natural soft feel; the right side of the face has been at times a little cooler than the left, and is so at the present time: it is, however, not so much so as to be perceptible to the patient; temperature of the right arm natural: that of the left, and the whole body, is above the natural standard, but it is moist; tongue is clean: having had no evacuation from his bowels since the operation, is directed to take a saline cathartic, in divided doses.

"1 A. M.—Complains of nothing; has not slept any; cathartic has operated twice.

"Third day, 5 A. M.—Has had no sleep in consequence of the operation of the medicine, it having produced free evacuations in the course of the night; skin not so moist, but of natural temperature; the two arms have equal warmth; pulse full, and rather more frequent than last evening: says his right elbow is a little painful, and the arm feels tired. The complete flexion of the arm at the elbow is prevented by a little rigidity of the extensor muscles.

"9 A. M.—He is now comfortable, has slept a little, and feels refreshed; pulse is full, and rather more frequent than natural; skin natural and moist: the size of the tumour is considerably diminished; has taken a dish of chocolate and some rusk.

"11 1-2 A. M.—Patient still free from pain, or any uneasiness; medicine has operated seven times; skin not hotter than natural, and moist; tongue clean; the right facial and anterior temporal arteries communicate a distinct pulsation to the fingers: having slept but little during the last night, directed him to take an anodyne of Tinct. Opii. gtt. xxx. and to have the room made dark, and kept quiet, in order to procure him some sleep: let him have sago or panada as often as he inclines to take nourishment.

"4 P. M.—Has slept the last two hours, and is still sleeping; respiration free and easy; nothing the least unnatural in his appearance.

"10 P. M.—He has slept four hours, and is much refreshed; is free from pain, except a little in the elbow; pulse small and soft, beating 105 strokes in a minute; tongue clean; feels a little soreness in the wound when swallowing; has taken a considerable quantity of sago and panada; his appetite is good; temperature natural and uniform in both arms.

"12 P. M.—Patient has slept the greater

part of the time ; is free from pain, and perfectly comfortable : skin moist and natural ; pulse soft, small, and frequent.

"*Fourth day*, 6 o'clock A. M.—Patient has passed a good night ; says his right elbow gives him some uneasiness, but complains of nothing else ; tongue is clean ; skin moist and natural ; can move the right arm with considerable ease ; says he takes as much light nourishment as he has been accustomed to for some time past : no unfavourable symptom has as yet made its appearance.

"11 A. M.—Symptoms continue much the same ; tongue slightly furred ; pulse comparatively small and soft, beats 105, and regular ; respiration has been uniformly natural since the operation ; suppuration has begun to appear through the dressings, and is attended with a little fœtor ; let them be covered with a yest poultice : it is thought that a faint pulsation, or undulation, is at intervals felt in the radial artery of the right arm : the left external carotid continues its increased action.

"6 P. M.—No change is observable in the patient's symptoms ; he still continues comfortable, and complains of nothing.

"*Fifth day*, 11 1-2 o'clock A. M.—The wound was dressed to-day : on removing the poultice the dressings were soft, and easily came away ; the suppuration was considerable, and of a healthy appearance ; it was found that the extremities of the two incisions were united as far as the sutures, each about one inch in extent ; one suture at the angle of the wound was removed ; the wound was dressed with dry lint, gently pressed into it ; adhesive straps and a compress ; his pulse beats 110, is fuller and stronger than yesterday.

"5 P. M.—Patient is very comfortable, subject to no pain or unnatural sensation ; pulse still 110, but softer.

"*Sixth day*, 6 A. M.—Patient sleeps ; respiration not attended with the least difficulty ; skin moist and natural.

"9 A. M.—He has rested well during the night, and is perfectly free from pain ; pulse 110, and soft ; skin moist ; tongue clean : having had no alvine evacuation since the 13th, directed to take of sulphate of soda ℥j, in divided doses.

"11 A. M.—The dressings were again removed, and the discharge seemed more considerable than at the former dressing ; the sides of the wound are granulating, and appear perfectly healthy ; on the ends of the muscles that were divided in the operation, there are small sloughs which are beginning to separate, leaving a healthy surface underneath ; wound was dressed with lint spread with Ung. Res. Flav. and adhesive straps : pulsation is now perfectly distinct in the branches of

the right external carotid artery : complains a little of the back part of his head, which he says is sore from lying ; in other respects is comfortable.

"6 P. M.—Has no pain, and is in every respect much as usual ; tongue clean ; skin natural ; says he feels "no weaker than before the operation."

"*Seventh day*, 6 A. M.—He has passed a comfortable night, and is free from pain or any uneasiness ; pulse regular and soft, and beats 105 in a minute ; skin moist, and of natural temperature.

"11 A. M.—The wound was again dressed ; suppuration considerable and healthy ; some of the small sloughs came away, leaving a healthy and florid surface beneath : sprinkled the wound with powdered carbon, then filled it lightly with lint, and over this applied the yest poultice, which was secured with adhesive straps : temperature of the two arms is the same, cathartic having produced no effect, *Habeat enema purgans statim.*

"9 P. M.—Symptoms have not varied materially : the enema has produced a copious evacuation : says he feels more comfortable, and desires to sit up in bed, which was allowed, taking care to have him raised up very cautiously, in order to prevent any exertion being made with the right arm and shoulder.

"*Eighth day*, 6 A. M.—Patient has rested well during the night ; says he feels some pain on swallowing, and that when the attempt is made, it gives rise to a fit of coughing, which fatigues him ; it also occasions some soreness in the wound ; pulse still soft, and less frequent than yesterday : he takes a reasonable quantity of light food every day :—Directed a cetaceous mixture for his cough, and is permitted to sit up for a short time, if he feels disposed.

"11 A. M.—Pulsation of the radial artery of the right arm to be felt occasionally pretty distinct ; cough has become more troublesome ; pulse 100 ; skin natural and moist. The dressings were again removed, and the suppuration is more profuse, apparently healthy, though attended with considerable fœtor ; appearance of the wound every way favourable ; small portions of the sloughs are removed at each dressing, and the sides of the wound look perfectly healthy ; the same dressings to be continued.

"6 P. M.—Complains only of his cough, which troubles him frequently ; can move his arm with much more facility, and has no pain in it ; circulation as before, and the temperature uniform and natural. The wound was dressed this evening in consequence of the fœtor being unpleasant to the patient : continue the dressings.

"*Ninth day*, 7 A. M.—Patient was found sitting up in bed, supported by a bed-chair, having passed a good night ; is in

good spirits, and expresses his gratitude for the relief afforded by the operation; says he can move the arm with greater ease, and it gives him no pain; pulse 105, regular and soft; skin natural; every symptom as favourable as could be wished.

"10 A. M.—Pulse less frequent, regular and soft; temperature perfectly natural; wound has a more favourable appearance, discharges less in quantity, and it possesses less fætor: dressed the wound as yesterday; tumour has diminished two-thirds, is soft, and less florid. The apex of the tumour is now below the clavicle.

"6 P. M.—Patient still in every respect as comfortable as at the last report.

"9 P. M.—Pulse 110, regular and soft: the dressings were removed this evening; the wound is much contracted in size, and is perfectly healthy, except a small slough which still remains in the deepest part of the wound: granulations are shooting up rapidly from the sides.—When preparing to renew the dressings, an unexpected and unaccountable hemorrhage took place, which suddenly filled the cavity of the wound. The rapidity with which the blood flowed, and the size of the stream, gave rise to fearful apprehensions for the man's safety: dry lint was immediately placed in the wound, and as much pressure made as the patient could conveniently bear, which quickly stopped it. After continuing the pressure for a short time, the lint was removed, when no hemorrhage recurring, the usual dressings were repeated: the patient experienced no ill effects from the bleeding, nor did he seem to be much agitated. At 10 o'clock P. M. has no pain, nor has he as yet had any sleep.

"Tenth day, 7 A. M.—Has passed a comfortable night, except that he has been frequently disturbed by his cough: tongue clean; skin moist; pulse soft, and has much less strength than before.

"11 A. M.—The dressings were again removed, and the wound made clean; its appearance is in every respect favourable; does not appear to have been the least injured by the hemorrhage: the dressings were renewed as before: he is directed to take half an ounce of the cold infusion of cinchona every hour, and to drink occasionally of ale when thirsty: has had an evacuation from his bowels to-day.

"6 P. M.—Symptoms much as before; complains a little of his elbow, and a numbness in his hand, to relieve which, he is directed to have the arm and hand rubbed well, and wrapped in wadding.

"Eleventh day, 6 A. M.—Patient has rested well during the night; cough has not been so troublesome; says he has no pain, and feels perfectly comfortable;

pulse better than yesterday; other symptoms as before.

"11 A. M.—The wound is dressed daily at this hour; its appearance is still very favourable, although there is still some fætor in the suppuration: the wound has contracted perhaps one-third; the tumour is also considerably diminished, and softer than before; pulsation in the right temporal and radial arteries as before: the same dressings to be continued.

"6 P. M.—No change in the patient's general symptoms; pulse soft, and rather more frequent; appetite is as good as usual.

"9 P. M.—Appearances have not varied.

"Twelfth day, 6 A. M.—Our patient was visited as usual this morning, but there is no evident change in any of his symptoms; says he now rests well at night.

"11 A. M.—To-day, when the dressings were removed, that portion of the slough which occupied the bottom of the wound (apparently a portion of the sheath of the vessels) came away: every part of the wound now, where its surface can be seen, has a healthy look: the most depending part is obscured by a quantity of pus, which cannot be wholly removed by lint, and it is not thought safe to permit the patient to lie in such a position as will allow it to be discharged: with the slough came away the ligature which had been applied to an artery under the lower portion of the sterno-thyroid muscle; it was followed by no hemorrhage: the wound was now dressed with pledgets of lint, spread with Ung. Resinæ Flavæ and adhesive straps. He remains much as yesterday, has drank freely of ale; pulse rather stronger than yesterday.

"Thirteenth day, 7 A. M.—No perceptible change in his symptoms; complains of no pain, and says he feels very comfortable; cough has given him very little trouble for the last two days; he is evidently considerably weaker than before the operation, but is not sensible of it himself.

"11 A. M.—The wound was again exposed; it is not as florid as yesterday, and there is a greater secretion of pus: the cavity of the wound was filled with dry lint only; the pus appears well formed, and has very little fætor.

"The same dressings were repeated in the evening; there is still a quantity of pus at the bottom of the wound, which rises and falls at each inspiration and expiration; it continues to contract above, leaving us uncertain of its extent beneath: during the last three days, the patient has sat up for several hours each day.

"9 P. M.—Pulse and skin perfectly natural; has had a natural evacuation from his bowels to-day; continues the infusion of bark as prescribed before.

"Wound was again dressed, and is as healthy as usual; suppuration just sufficient to moisten the lint: the same dressings to be continued.

"*Fourteenth day, 7 A. M.*—Patient has slept well during the night, and is as well as usual; complains of soreness of the ulcer which he has had for some time between his shoulders; it is improving in its appearance, and is directed to be dressed as usual with Ung. Resinæ Flavæ. The erysipelatous blush which surrounded it, is not as florid as heretofore; it is beginning to granulate, and assume a healthy appearance: in other respects he is perfectly comfortable: he is now able to raise the right arm to his lips, which he has not done since the fourth day after the accident by which his shoulder was injured; says, too, that he is getting stronger, and that he walked across the floor this morning without any assistance.

"*11 A. M.*—On removing the dressing, the granulations appear perfectly florid and healthy: the bottom of the wound is not visible, owing to the small quantity of matter which collects there, and from its depth cannot be easily removed, and perhaps not altogether safely: the position of the patient in bed must necessarily make the bottom of the wound the lowest: when he coughs or swallows, a small quantity of fluid pus at the bottom of the wound is seen to rise and fall; from the general appearance however of the wound, the man's feelings, and many other circumstances, it is not probable that there is any considerable quantity: the large ligature lying very loose in the wound was taken hold of, merely however to see if it was separated; no force was used: pulsation of the right radial artery more distinct than heretofore: countenance of our patient is improving; says he feels more comfortable than before the operation: he can now straighten his arm, and raise it to his mouth with facility: as yet he has not recovered his strength, but is improving daily; has been sitting up all day: directed him when lying down to assume a more recumbent posture; continue the sulphuric acid and infusion of cinchona, as before: complains of the ale being too strong; let it be diluted and made pleasant with sugar and nutmeg.

"*9 P. M.*—The large ligature, since the operation, has been confined upon the upper part of the sternum by a piece of adhesive plaster, to prevent any accident during the dressings. Upon dressing the wound this evening, the large ligature, as it lay in the wound, appearing to be loose, was again taken hold of with the forceps, and found floating upon the pus, being completely separated from the artery below. The ligature was drawn so firmly upon the artery, that the noose

was only large enough to admit the rounded end of a common probe. The wound looks healthy, and is contracting rapidly; it is now perhaps not more than one-third of its original size. Suppuration is now only sufficient to moisten the lint through.

"*Fifteenth day, 12 o'clock.*—The patient is comfortable in every respect; pulse and skin perfectly natural; is sitting up in bed, and occasionally amusing himself with a book; not the least symptom about him indicating indisposition: wound is healthy, and continues to improve in appearance. The right arm at intervals gives him a sensation of numbness: not more, however, than can be accounted for from the uniform position in which the arm rests, and no doubt a more languid circulation, as it is readily removed by a little friction and motion of the arm. His appetite improves, and he expresses a desire to walk about the room. The bark and sulphuric acid to be continued.

"*9 P. M.*—In the afternoon he was removed down stairs, from the private room in which he was placed immediately after the operation, to the ward in which he formerly lay, and appeared highly gratified with the idea of again seeing his friends, whom he had left with very little hope of ever returning to. The wound, upon being dressed, did not appear to have undergone any perceptible change.

"*Sixteenth day, 11 A. M.*—Our patient's strength is improving. To-day he made an effort, and with success, to visit his friends in Ward No. 7, where he lay previous to his being transferred to the surgical department, and returned, without having any support; pulse as strong as before the operation, and in every respect natural; appetite better than before the operation; cough a little troublesome, but less so than for several days previous; wound dressed with dry lint.

"*9 P. M.*—Dressings removed; patient as before; suppuration small in quantity, and appears to be well-formed pus, and is not attended with the least fetor.

"*Seventeenth day, 11 o'clock.*—The ends of the divided muscles are nearly in contact, and the surfaces of the wound are rapidly granulating, and in every respect look well: patient's health continues to improve; he walks about the room with perfect ease, and into several wards in the same story; the ability to move the arm increases; pulse and skin natural. The dressings were removed at 4 P. M., and also at 10 P. M.

"*Eighteenth day.*—The patient's strength continues to improve; every symptom remains highly flattering; cough less troublesome. The dressings were again removed to-day three times.

"*Nineteenth day.*—Continues the same as yesterday; wound dressed three times.

"*Twentieth day.*—To-day he passed down two pair of stairs, and walked several times across the yard, and was highly delighted with his performance, and felt not the least inconvenience from it; sleeps uniformly well during the night, and takes more food during the day than he did previous to the operation; continues the infusion of cinchona and sulph. acid as before, and directed to use dry lint as the dressing.

"*Twenty-first day.*—Dressed the wound three times again to-day; it is nearly closed at the bottom; the power of motion in the right arm continues to increase: he can now move it with as much facility as the left, though not to the same extent: his strength is daily improving, and the operation is considered by all to have been completely successful; size of the tumour continues the same, no diminution of it having been perceived for the last week; the most prominent part of the tumour is yet below the clavicle, that above rises to about the height of the clavicle, which gives a little convexity to the place between the clavicle and trapezius muscle.

"*Twenty-second day.*—Continues to improve in every respect; dressings renewed as often as yesterday; owing to the weather, he has not left his ward to-day; pulse full and strong; temperature of both arms the same.

"*Twenty-third day.*—A few minutes before the hour of visiting, to-day, a message was brought, that the patient was bleeding from the wound. The dressings were immediately torn off, and dry lint crowded into the wound, and slight pressure applied for a few minutes, when the hemorrhage ceased. The patient lost at this time, perhaps, about 24 ounces of blood, and was very much prostrated. Pulsation ceased in the radial artery of the left arm, and the countenance, gasping, and convulsive throes of the patient, threatened immediate dissolution: all present apprehended the instant death of the patient. The first impression was, that the trunk of the arteria innominata had given way. The conjecture afterward was, that the subclavian artery, from the diseased state of it, had not united by adhesion, and that the fluid blood from the tumour had regurgitated through its ulcerated coats. This appeared to be the most probable, both from the suddenness with which the blood ceased flowing, and the cause the patient assigned for the hemorrhage. He says that he felt weary of lying on his left side and back; that he had just turned on the right, which he had not done before since the operation, agreeable to my re-

quest. At the instant of turning over, something arrested his attention, which caused him to turn his head to the opposite side suddenly, and he felt the gush of blood from the wound.

"He was directed some wine and water frequently, which soon revived the circulation. The wound was dressed with dry lint and a compress. Pulse as frequent as natural, but very small and soft: he appears very languid, and complains of a numbness and painful sensation in his hands; says also that his back aches. During the last twenty-four hours he has taken a pint and a half of Madeira wine: he also took occasionally some egg and wine, which was immediately rejected from the stomach.

"9 P. M.—Patient has lost his appetite, and appears considerably depressed; circulation very languid in the right arm; temperature of it is a little less than the left: directed a hot brick to be wrapped in flannel, and placed close to the arm. For a profuse perspiration which he has been in for the last three hours, he was ordered to be bathed with cold rum.

"*Twenty-fourth day, 6 A. M.*—Slept the greater part of the night, and feels comfortable; is still languid, and has no disposition to eat any thing; says he feels sick, and once last evening vomited after drinking some wine and water.

"Wound looks exceedingly pale, and the discharge is thin and fetid, for which the carbon and yest dressings were applied. He has vomited several times to-day, and has some considerable difficulty in swallowing, and complains of a soreness in the wound upon pressure.

"9 P. M.—Dressings removed; wound very pale; right arm of the natural temperature; feels occasionally a little numbness in the hand; has taken very little nourishment during the day; pulse natural, as to frequency, but small and feeble; a few minutes after dressing the wound, information was brought that hemorrhage had ensued, and before it could be commanded, he probably lost four ounces of blood. For his restlessness and pain in the bones he was ordered two grains of opium.

"*Twenty-fifth day.*—Has rested well during the night, and is perhaps a little better this morning. The repeated hemorrhages have debilitated him exceedingly, and from the irritable state of the stomach he can take only a very little nourishment. In the morning he was directed the effervescing draught to be repeated every two hours; this allayed the irritability of his stomach, and enabled him to take a little breakfast.

"His countenance has altered since the first bleeding surprisingly, his eyes are now heavy, and for the most part fixed: his cheeks are sunken, and an universal

pallor has spread itself over his countenance; and, from every appearance, a short time will terminate his existence. He has not vomited since early in the morning; is advised to take a little soup, and to drink freely of wine and water; dressings were renewed at 3 o'clock P. M., shortly after which the patient again bled, but not to exceed, however, an ounce. He was dressed with dry lint, as usual.

"11 P. M.—Patient has not as yet had any sound sleep, is restless, and apparently distressed, although he says he feels no pain; breathing is attended with some difficulty; his hands and legs are continually in motion; pulse small and feeble.

"*Twenty-sixth day, 6 A. M.*—Patient has not rested well; is occasionally falling into little slumbers, but is awaked by the least motion: pulse small and feeble; respiration somewhat laboured; appears to be sinking; seems disinclined to take any thing; legs and arms constantly in motion.

"11 A. M.—More feeble than before: has been forced to take a little chocolate; is evidently sinking; wound was dressed, but there was no secretion of pus in it; countenance of the patient foretells his approaching dissolution.

"6 P. M.—Is extremely low; respiration very much laboured: is not able to articulate: for the last three hours there has not been such continued throwing of the legs and arms about the bed: he lays in a state of insensibility; *temperature of the two arms the same to the last.*—My pupil, Abraham I. Duryee, the House Surgeon (to whom I am indebted for the correct reports, and the most unwearied attention to this case, and whose ingenious application of means, for the recovery of many of my patients, will long be held by them in grateful remembrance,) having for a few minutes left the patient, he was sent for immediately, as there was another bleeding from the wound, by which he lost probably eight ounces of blood: during the whole time he did not manifest the least appearance of consciousness, nor was the least motion perceptible, except that necessary for respiration and circulation: the hemorrhage was stopped with lint, after removing the former dressings; respiration is now performed with the utmost difficulty, and the patient appears as if every respiration would be the last: he expired at half past six in the afternoon: the temperature of the right arm, after death, appeared by the touch to be the same as the left; it was as natural and uniform as other parts of the body.

EXAMINATION OF THE BODY.

About eighteen hours after death, I opened his body; there was considera-

ble emaciation, and the surface of the wound was of a dark-brown colour, and fetid; the wound was perhaps about one-third of its original size; it had been enlarged by the pressure of lint into it, and other means to arrest, from time to time, the hemorrhage: the ulcer between his shoulders was ill-conditioned.

"For the purpose of examining the condition of the aorta, where the arteria innominata is given off, as also the origin of the latter vessel, as well as the state of the pleura at the part about which the ligature had been applied around the artery, the chest was opened in the following manner: after removing the integuments and muscles from the forepart of the chest, the sternum was carefully sawed through, about an inch from its upper extremity, and raised by sawing through the ribs below the junction of the cartilages: this removed so much of the front part of the chest as to facilitate and expose fully to view the subsequent steps of the dissection; by thus leaving the clavicles attached, every part connected with the ulcer and great vessels could be seen and examined in situ.

"The arch of the aorta and origin of the innominata being fairly exposed, not a vestige of inflammation or its consequences could be discovered, either upon them, the lungs, or the pleura, at any part. An incision was next made longitudinally into the aorta, opposite the origin of the innominata, and upon introducing a probe cautiously up the latter vessel, it was seen to pass into the cavity of the ulcer; the innominata was then laid open with a pair of scissors into the ulcer; the internal coat of this vessel was smooth and natural about its origin, but for half an inch below where the ligature had cut through the artery, it showed appearances of inflammation, and there was a coagulum adhering with considerable firmness to one of its sides; showing that nature had made an effort to plug up the extremity of so large a vessel, after the adhesion, which no doubt had been effected by the ligature, was swept away by the destructive process of ulceration. The upper extremity of this vessel was considerably diminished in its diameter by the thickened state of its coats, occasioned by the surrounding inflammation. The innominata, about half an inch from the aorta, and a little to the left side, gave off an anomalous artery, large enough to admit a small size crow-quill.

"The ulcer at the bottom was more than twice the size of the wound in the neck; it extended laterally towards the trachea and under the clavicle towards the tumour. The tripod of great vessels, consisting of the innominata, subclavian, and carotid arteries, to the extent of

nearly an inch, was dissolved and carried away by the ulceration. The extremities of the two latter vessels were found also to open into the cavity of the ulcer. The upper surface of the pleura was very much thickened by the deposit of newly organized matter, for the safety and protection of the cavity of the thorax. Indeed, instead of having increased the danger of penetrating this membrane, the adhesive inflammation which preceded the ulcerative, seemed, by the consolidation of cellular membrane, and the addition of new substance, to have more securely and effectually shielded it from danger.

"The internal surface of the carotid artery was lined with a coagulum of blood, more than twice the thickness of its coats, and extending above the division into internal and external, so as almost to give them a solid appearance, inasmuch that a probe could barely be introduced. The subclavian artery, internally and externally to the disease, was pervious. The brachial and other arteries of the right arm were of their common diameter, and in every respect natural. The external thoracic or mammary arteries, as they went off from the subclavian, were larger than natural: the right internal mammary was pervious, and of the usual appearance. Upon opening into the tumour, which now gave (from its small size) no deformity to the shoulder, the clavicle was involved in it; and found carious, and entirely disunited about the middle. A number of lymphatic glands under the clavicles, and particularly the left, were considerably enlarged, and, when cut into, very soft, and evidently in a state of scrofulous suppuration.

"Where the subclavian artery opened into the ulcer left from the wound of the operation, it appeared not only pervious, but of the natural size, and the coats free from any diseased appearance. Externally towards the axilla the artery was somewhat enlarged in diameter, but exhibited no appearance of disorganization of its coats either externally or internally. About an inch from the ulcer, or just as the artery had passed between the scaleni muscles, there was an irregularly shaped elliptical opening upon its upper side, though large enough to receive the extremity of the fore-finger. The edges of this opening were jagged and uneven, and the surface of the artery internally was of a brownish yellow colour to the extent of half an inch on the inside of the opening, and more than an inch towards the axilla. The internal coat of the artery had a rugous or puckered appearance, separated a little from the muscular coat, very friable, and evidently in a degenerated state. This opening of the artery communicated directly with the an-

terior extremity of the sac, which contained the coagula; and upon removing these, the surface of the sac was seen puckered, or thrown into a great number of little folds, giving it at first sight the appearance of containing a number of holes.

"Several very important facts are established by this operation—facts which no surgical operation has ever before confirmed. It proves very conclusively, that the heart, the brain, and the right arm, were not the least injured by it in any of their functions. To tie so large a vessel so near the heart, might very reasonably be expected to occasion some immediate derangement in the actions of that organ: but it was neither increased nor diminished in its contractions, nor did it give rise to the least visible change in its respiration. All this could not have been anticipated. I apprehend there are no ingenuous surgeons, who would not have expected quite a contrary result. For my own part, I must confess, that this was to me an anxious moment, when I drew the ligature upon this artery. Indeed, so apprehensive was I that some serious, if not almost immediately fatal consequences, would follow, from arresting so large a proportion of the whole mass of blood suddenly, that I drew the ligature very little at first. But when no change took place in the actions of the heart, or respiration, I felt a confidence in completely intercepting the whole current of blood through this great vessel.

"The brain in no operation has been deprived of so large a quantity of blood as in this, and yet it suffered no inconvenience: from the effect of experiments however upon animals, I entertained no fear as to the consequences of my operation upon this organ.

"The right arm, as the reports of the case from day to day will show, was in no want of a sufficient supply of blood for the purposes of its economy. That circulation went on to a degree adequate to its wants, the natural warmth and function of the skin fully prove; and although at no time could all be satisfied that a pulsation was perceptible in the radial artery, yet many at times were of the opinion, that an occasional undulatory motion was very evident: every one was confident of the distended and elastic feel of this artery, and could plainly see, from pressing on the distended veins upon the back of the hand, that a free circulation of blood was going on: but independent of these evidences, the natural warmth and free perspiration would alone be sufficient to establish the fact.

"The route of circulation to the right arm was somewhat different, at first, from what took place after the ulceration had extended. The inosculature of the

epigastric and internal mammary must have thrown a considerable retrograde current of blood through the latter vessel into the subclavian directly, and which in all probability passed on into the arm: after the ulceration had extended, this communication was cut off by the destruction of the subclavian to some distance. It was now that the principal supply of blood to the arm must have been derived from the free communication of the intercostals with the thoracic arteries. From the large size of these, as found in the dissection, I apprehend they must have afforded the principal channels through which the blood was conveyed to the arm after the operation: the anastomoses of the infra-scapular and other arteries of the axilla, more or less with small branches of the intercostals, as also the occipital, with small ascending branches from the subclavian, may have given some trifling assistance.

"The ulceration which went on so insidiously at the bottom of the wound, was the sole cause of the death of my patient. While the upper part of the wound put on a favourable appearance, and seemed healing, mischief was extending below. The separation of the ligature on the fourteenth day, spontaneously, without being followed by any hemorrhage for a number days, and not until ulceration had extended, conclusively proves to my mind, that all the purposes of the ligature were completely answered—that adhesion was fully effected. Had it not been for the ulcerative inflammation, no doubt will be entertained, I think, by surgeons, but that my patient would have recovered. From occupation, his constitution was indeed very old, and with an ill-conditioned habit, every thing favoured the process of ulceration. The position of the wound may be said by some to favour this process, but in a sound healthy habit it would only retard the wound in its recovery, but would never promote ulceration.

"The practicability and propriety of the operation appear to me to be satisfactorily established by this case: and although I feel a regret, that none know who have not performed surgical operations, in the fatal termination of it, and especially after the high and just expectations of recovery which it exhibited; yet I am happy in the reflection, as it is the only time it has ever been performed, that it is the bearer of a message to Surgery, containing new and important results."

I have now to refer the reader to the several periodical publications which have cavilled at this operation, when he will, by viewing their criticisms, have further confirmed the splendid nature of this surgical performance. See *American Medi-*

cal Recorder, Vol. 2, p. 78. *London Medical and Physical Journal*, Vol. 42, p. 145. *New-York Medical Repository*, (new series,) Vol. 5, p. 162.

INGUINAL ANEURISMS.

When we compare the method for taking up the external iliac artery, as performed by Sir Astley Cooper, with that practised by Mr. Abernethy, we are at no loss to which to give the preference. The trifling disturbance of parts in the one case, contrasted to the extensive division of muscular structure in the other, will induce us to decide in favour of the former plan.

It appears, that the principal indications to be fulfilled in the performance of this operation, are, first, to preserve the peritoneum from an unnecessary disturbance; and, secondly, to avoid detracting from the support afforded the abdominal contents by the muscular parietes.

In the method practised by Sir A. Cooper, the incision through the tendon of the external oblique muscle is carried in a direction nearly parallel to its fibres; from which circumstance, the action of the muscle after the operation, has a tendency to close the wound; and from the internal oblique and transversalis remaining uncut, the least possible weakening of the walls of the abdomen ensues. But in the first mode practised by Mr. Abernethy, and followed by most of the surgeons who afterward undertook the operation, the three abdominal muscles were divided to the extent of about three inches, and in some cases four inches, in a perpendicular line from Poupart's ligament, by which the abdominal muscles were cut in a direction at right angles with their fibres, from which a great gap must have immediately followed from the contraction of those muscles, that would have remained, so far as regards the presence of muscular substance: and that this space is not filled afterward by a substance equal to give as much strength and support to the contained viscera, is proved by the supervention of hernial protrusions at these very parts. Such an instance is recorded by Mr. Kirby, of Dublin, in a case wherein he tied the external iliac artery according to Mr. Abernethy's plan. He adds to the detail of that case, "A hernia prevails where the abdominal muscles were divided." In the case operated on by Mr. Stevens, of Santa Cruz, a very large hernia exists, protruding at the part where the parietes were cut to get at the internal iliac artery. He made an incision five inches in length parallel to the epigastric artery, which was almost at right angles with the fibres of all the muscular struc-

ture in that situation, and the consequence was as I have stated.

Having had opportunity to operate in two instances in the living subject, for securing the external iliac artery within a ligature, and adopting the method of Sir Astley Cooper, as described by Mr. Hodgson, and quoted in the text of this dictionary, I was struck with the facility with which the artery could be surrounded, by introducing the needle through the natural opening in the fascia transversalis. I have since taken many opportunities to exhibit this operation in the dead subject, and have informed myself that it can be taken up at a distance of nearly two inches from where it lies under Poupart's ligament, by seeking for it through the internal abdominal ring, and without disturbing the fibres of the internal oblique or transversalis. I have found also, that a very slight division of these would give room to reach it nearly to where the internal iliac is given off. I have moreover tied the internal and common iliac arteries with the greatest ease in the dead subject, after separating the internal oblique and transversalis muscles from Poupart's ligament as far as the anterior superior spinous process of the ilium, by cutting outwardly from the internal abdominal ring.

In this way can these operations be performed, and the division of the parietes from the ring will not exceed two and three quarters inches in the adult subject. The opening, however, through the tendon of the external oblique muscle will be somewhat greater, by being extended through that part of it which covers the spermatic chord, and is over the oblique canal; yet the incision will be in the direction of its fibres.

This method will be found in detail in the first part of my Surgical Anatomy, published this year, accompanied by a plate, which is the fifth in the series; showing a ligature around each of these vessels, in situations in which they had been applied after the arteries had been got at by prosecuting the dissection as recommended. (*Surgical Anatomy, part first, p. 147.*)

AORTA. The circumstance of the constriction sometimes suffering comparatively little injury under wounds of the peritoneum, is not sufficient to lead us to feel safe when accidents occur to this structure. And to avoid wounding that highly sensible and delicate membrane, must be held an established maxim in surgery, when operating near the abdominal cavity.

I will hardly presume to think that Sir Astley Cooper's patient, in whom the aorta was tied for aneurism, might have died from peritoneal inflammation; yet that event, perhaps, might be as readily

inferred, as that the man's death, within forty hours after the operation, was to be attributed "to the want of circulation in the aneurisinal limb." And although "on opening the abdomen there was not the least appearance of peritoneal inflammation, *except at the edges of the wound,* and" though "the omentum and intestines were of their natural colour," might he not have sunk pursuant to the shock experienced by the nervous system, in the demand made upon it to support a general inflammation of the abdominal cavity; even such an one as was to be expected, *a priori*, upon the slightest wound into the peritoneum? Or in other words, might not the patient have undergone the constitutional symptoms attending peritoneal inflammation, and to an amount to have produced death; notwithstanding evident marks of that inflammation were not observable among the *post mortem* appearances; from having been withheld, owing to the excess of impression upon the nervous system, in the first instance? Be that, however, as it may, it requires little argument to prove, that in performing so great an operation as that of surrounding the aorta with the ligature, the safest method is to be adopted: and if it is possible to get at the vessel as easily to the surgeon, and as safely to the patient, without wounding the peritoneum, such a plan should certainly be resorted to. I have accordingly taken the liberty to propose a method for securing this vessel, which I have frequently practised on the dead subject; and if it ever fell to my lot to tie that artery in the living, should prefer it to any other.

I would commence an incision beginning over the extremity of the last or twelfth rib of the left side, and continue it through the common integuments as far as the anterior superior spinous process of the ilium. Thus I would lay bare the external oblique muscle, which I should divide for the same extent; this incision would be almost in the course of its fibres. The internal oblique and transversalis muscles I would also divide in the line and to the extent of the first incision. These muscles readily retracting, would expose the fascia transversalis, which part I would lift with a pair of dissecting forceps, and open it as directed in the case of a hernial sac. I would then introduce my finger, and extend its division by means of a bistoury as far as the first cut through the common integuments; being cautious to avoid any injury to the peritoneum underneath. I would after this, elevate the peritoneum from the posterior abdominal parietes, by insinuating two fingers, while I supported with the other hand the part raised, until I had separated as far as the attachment

of the mesentery, at the forepart of the lumbar spine. I should now see and feel the artery above its bifurcation, and be able, with a properly curved aneurismal needle, to pass a ligature around it, and to draw the knot by the contrivance made use of for the extirpation of the tonsils.

To facilitate such an operation, as remarked in Sir A. Cooper's case, it would be expedient to approximate the shoulders to the pelvis, that the abdominal muscles might be relaxed; and also, previously, to empty the intestinal canal, that no difficulty should be experienced in elevating the peritoneum, from the pressure of the abdominal viscera.

BLEEDING.

ARTERIOTOMY.

Every one must have witnessed the trouble and embarrassment that frequently attends the attempt to draw blood from the temporal artery. It is always difficult to succeed by simply striking the artery with a lancet; for although the vessel itself is pretty firmly bound down to the fascia over which it has its course, yet the common integuments at this part of the head are very loosely connected; so that it is hardly practicable to make at once, the cut through them and that into the artery, opposite each other; and retain them in that relative situation. Hence we have, as a frequent attendant on this operation, an extensive ecchymosis, the existence of which hinders the application of the necessary pressure; which that kind of performance requires, or preventing an after hemorrhage. And when, from the difficulty experienced in stopping the bleeding, it becomes expedient to cut the vessel across to restrain it, a new embarrassment presents itself, from the trouble of finding the vessel among such extensive ecchymosis.

To avoid this evil, then, to be enabled to command a certain quantity of blood, and the more easily to restrain the hemorrhage when enough has been extracted, I have been in the practice of first cutting down by the side of the vessel with a scalpel or lancet; of separating it from its attachments; then lifting it upon a probe, after which, of opening it obliquely with a lancet, and taking as much blood as was required. The vessel lying upon the probe; I cut the vessel across, when it would immediately retract, and the bleeding instantly cease. After this a piece of adhesive plaster without pressure will be generally all that would be required. The probe being under the artery while the bleeding is going on, I should, by cutting it free, be under no doubt of having completely divided the vessel.

BRONCHOCELE. The following is from the Quarterly Journal of Foreign Medicine and Surgery, No. 11, p. 348; being an extract from a Memoir which M. Coindet published in the February number of the Bibliothèque Universelle, on the subject of Iodine as a remedy in this disease.

"Of all the preparations of iodine, that of the hydriodate of potash with a superabundance of iodine is the most manageable, and the one which produces the fewest accidents. For its preparation, 36 grains of the hydriodate of potash, and 10 grains of iodine are dissolved in an ounce of distilled water. From 6 to 10 drops are at first prescribed three times a day, and the dose is increased or diminished according to the effects produced. M. Coindet is of opinion, that it is necessary to observe the time when the iodine is about to manifest its action, so as immediately to suspend its exhibition, and resume it eight or ten days afterward, that is, at the moment when the action of that before administered must terminate; again to suspend it and resume it, in observing nearly the same rules as every prudent practitioner follows in the administration of mercury, rules which have not always been kept in view by those who have made use of iodine, and the neglect of which diminishes the success of the remedy.

The following are the alarming symptoms observed by the author:—Acceleration of pulse, palpitation, dry cough, watchfulness, marasmus, and prostration of strength; sometimes swelling of the legs, tremours, painful hardness of the bronchocele, diminution of the breasts, or a remarkable augmentation of appetite, supervene; and, he adds, that in almost all the instances which he has observed, to the number of five or six, a very rapid diminution, or a disappearance, more or less complete, has taken place during those symptoms, even in hard, bulky, and old bronchoceles. On some patients the medicine acts almost immediately, while on others no apparent effect is produced, even after they have taken it for several weeks in succession. An example of its quick action is related, which occurred in a man who had had an enormous bronchocele in the two lobes of the thyroid body for a long series of years. Its increase was progressive, and it was very hard to the touch; the patient complained of choking and oppression when he walked, stooped, or went up stairs, but in other respects he enjoyed good health. He took thirty drops of the medicine daily, but on the fifth day complained of an increase in the size of the bronchocele, aphony, and rather severe pains, which required the suspension of the iodine, and the repeated applica-

tion of leeches and poultices to the part. In fifteen days he had recovered his former state, with the exception of hoarseness: the bronchocele was also considerably diminished and softened. Two months after the commencement of the treatment, the remedy having been again administered during four days, and again discontinued, the bronchocele was sufficiently diminished to free the patient from all inconvenience.

"M. Coindet considers that the iodine is contra-indicated when the constitutions of patients are remarkably delicate, nervous, or weak. But he has seen its exhibition attended with admirable success when the precautions he recommends have been observed, and the patients were affected with no other complaint than bronchocele; but above all, when they were at an advanced period of life. The following is an example of its beneficial operation; it occurred in a woman, seventy-five years old, who was affected with pains in the head, a tendency to drowsiness, and so great a weakness and numbness of the right arm, that she thought she touched every thing through a glove. These symptoms increased as an immense bronchocele was developed in the right side of the thyroid body, as it were in an acute manner; for although it had commenced thirty years before, it had during three months been increased in bulk nearly as much as the size of the fist. It evidently interfered with the circulation in the brain, and compressed the brachial plexus. By the employment of the iodine, the disease was arrested after a fortnight; in thirty days the bronchocele and bad symptoms were diminished. In a month afterward the swellings, paralysis, and affection of the head, were all entirely dissipated.

"The credit of the remedy is supported by other authorities besides that of M. Coindet; and the name of Breschet is mentioned as having communicated the results of his practice on this point to the Société Médicale d'Émulation, coinciding with the above stated facts."

BRONCHOTOMY. I had lately handed me, by Professor Mott, the memorandum of an interesting case, wherein this operation had been successfully performed by him; and of which the following is a summary.

He was called to the child of Mr. B. of this city, of the age of ten months, in August, 1820, at about forty hours after the half of a peanut-shell had found its way into the larynx. The child at this time was nearly suffocated, having the symptoms of croup in a most aggravated degree. Having been made acquainted with the circumstances of the case, the only method that could be pursued immediately presented itself, to wit, the

performance of bronchotomy. The neck of the child being short and fat, with the high irritation under which it laboured, the operation in this instance was neither desirable, nor did the operator, by it, anticipate any permanent advantage. Yet, however, as the case admitted no delay, he began by making a longitudinal incision of about an inch and a half in length upon the trachea perpendicularly to the sternum through the common integuments. This bled freely and increased much the restlessness of the child; so that the operator was half inclined to hesitate any further proceeding. However, after a cautious use of the sponge, he at length ventured to pass a lancet between two rings of the trachea, just below the cricoid cartilage and the joining of the lobes of the thyroid gland. This was immediately followed by a great gush of bloody mucus of a brownish colour, and the breathing became immediately relieved. The next step was to withdraw the nut-shell; to effect this two probes were bent at their blunt extremities and passed between the rings of the trachea, for the purpose of giving an opportunity of seeing, if possible, the situation of the extraneous substance. There was great difficulty, however, in applying the probes, for, during the efforts of respiration the opening into the trachea was drawn alternately under the integuments above and below, beyond the extremities of the first incision. But the part being at length caught by the probes, it was held in a fit situation, so that the piece of nut-shell was seen within the larynx, opposite the cricoid cartilage. The probes being held by an assistant, the doctor, with the forceps, easily extracted it. The part being still retained by the probes, he had an opportunity of seeing within the tube above and below, and found an effusion of coagulable lymph, as observed in croup, lining the larynx and trachea above the wound. A probe passed upward produced excessive irritation and coughing, with suspended respiration during the intervals, but when passed downward, even as far as the division at the bronchiæ, the child showed no signs of irritation. The doctor now attempted to peel off the exuded coagulable lymph, which he did by aid of a probe, then withdrew it with the forceps. The layer of lymph was firm, and of much tenacity in itself, but was easily separated from the side of the larynx. The membrane of the larynx, where the lymph was situated, was observed highly florid, marking high inflammation, the effect of the presence of the extraneous body. At the end of the operation the breathing was found additionally relieved by the removal of the layer of coagulable lymph from the larynx. The doctor, now much satisfied

with the result of the operation thus far, prepared to dress the parts, which he began by applying strips of adhesive plaster; but he had no sooner closed the wound than the child's immediate death was threatened, which obliged him quickly to tear away the dressing, and allow the infant to breathe again by the opening he had made in the trachea. In this state the patient was permitted to remain for eight days, in which time the side of the neck, and the breast were blistered, and an active antiphlogistic treatment made use of for subduing the inflammatory symptoms. After this he was able to bring the parts together; upon which the child did well. This, I am informed, is the first instance of the successful performance of this operation in New-York.

It does appear to me, that the circumstances attending this operation are very decisive in favour of the operation of bronchotomy as a remedy for croup.

CARBUNCLE. I have to add to the value of this article, by inserting from the experience of Dr. Physick in Anthrax. It will have been observed, that Mr. Cooper speaks in the most decided manner against the use of caustics in this disease; and seems to depend solely upon constitutional treatment for the removal of this complaint. But Dr. Physick is of opinion, that the common caustic vegetable alkali, as a local application, is highly beneficial, provided it is made use of at a proper period of the malady. In elucidation of this sentiment, he has given an instance, in which is detailed the progressive treatment towards a cure of an inveterate case of carbuncle; and afterwards explains the rationale of the practice.

He considers, that the disease is rightly divided into three stages, which require to be traced, in order that the application of the caustic may be regulated and used to advantage.

"The first stage to be that in which the disease is forming, and in which the peculiar inflammation exists in the cellular texture, under the skin, that ends in its death or mortification. This is attended by a burning pain, and sometimes by fever."

"The second stage, that in which pimples appear with orifices through the skin, which, gradually increasing, join, and eventually form one or more large openings, through which the mortified parts and ærial fluids pass out. These effects are produced by the ulcerative process, which, during the whole time of its continuance, is attended with the most severe and distressing pain that is experienced in the course of the disease. The patient's constitution also suffers so materially, owing to loss of appetite, want of

sleep, and fever, that death is the consequence in severe cases." And

"The third stage, is that in which an ulcer remains, attended, however, with no peculiarity from its cause."

Dr. Physick, therefore, has found all stimulating applications in the first stage of the disease highly improper; and considers the use of caustics at that period as particularly injurious. He had, however, once thought, from what he observed as the effect of blisters in checking mortification proceeding from some kinds of inflammation, that they would be useful in arresting the progress of carbuncle. Yet in his experience they have not shown any power in counteracting its progress to mortification. But it is in the second stage that he recommends the caustic, for the purpose of facilitating the discharge through the skin of the mortified cellular membrane, in which the inflammation had originally been situated. And adds, in all cases in which he had used it, at this period of the disease, the sufferings of the patient ceased as soon as the pain from the caustic had subsided. Its operation being, by accomplishing in a few minutes, what, if left to the process of ulceration, would require several days, to the great suffering and consequent loss of the powers of the constitution of the patient. (See *Philadelphia Journal of Medicine*, Vol. 1, No. 3, p. 172.)

FISTULA IN PERINEO. I enlarge upon this article, not for the purpose of introducing any new practice, but for recording a curious case, which turned out to be a very complicated instance of fistula in perineo.

Mr. W. a gentleman of Elizabethtown, N. J. of forty years of age, and who had lived freely, began about eighteen months before his death to complain of an almost constant pain in his back, which appeared like a rheumatic affection; after some weeks' treatment by the usual means for that disease, the symptoms were in a measure subdued, but there still remained a febrile disposition which could not be got under. About a year after this period Dr. Mott was sent for from New-York, in consequence of a peculiar discharge accompanying the flow of urine, this he soon found to be of the nature of fœces, which, however, the patient was most unwilling to believe. Examination was made by the rectum, to ascertain if there was any communication between that gut and the urinary bladder; but none could be found; neither was there any tumefaction or tenderness at the perineum, that would indicate the forming of a fistula in that situation. He was directed to pay attention to the state of his bowels, in order that the feculent discharge might be as much as possible in a fluid state. He passed a number of weeks

after this under a constant hectic irritation, until at length an uneasiness was felt in perineo, then a tumour, and quickly a spontaneous opening was formed, which discharged matter, urine, and faeces. By an examination through this new-formed opening no communication could be traced with the rectum, but the cavity of the fistula was found supplied with urine and faeces from an opening through the membranous part of the urethra. From this time until the patient was carried off, he spent his life in great distress, becoming much emaciated, with continued hectic; the fistulous orifices in perineo amounting to four or five in number, from each of which extensive excavations were made between bladder and rectum, and these parts and the sides of the pelvis.

At about two months before his death, a fish-bone was discharged by perineum, incrustured with calculous matter.

At his decease, the Doctor having much anxiety to inspect the body, obtained permission for an examination, and found upon searching the abdominal cavity, that the rectum descended the hollow of the sacrum far to the right side, and opposite the right ileo-sacral articulation; while the sigmoid flexure of the colon was in its usual place. But there was a straight portion of the colon connecting the sigmoid flexure with the beginning of the rectum, and placed before the base of the sacrum. This was an anomaly, called by Dr. Mott, in his communication to me, *a pelvic arch* to the colon. I believe such a variety has been before noticed by an European author, whose name I have not at present in mind. Between this portion of the colon and the urinary bladder, there was an opening by which the two cavities were connected, but not in a simple manner. There was a sac placed between them, as if the fish-bone, in its effort to escape, had projected the side of the gut towards the fundus of the bladder, previously to any adhesion being formed; after which the communication was effected with the vesica urinaria.

I have been made acquainted with another case something like the one sketched; but as the patient is at this time in life, I do not know that it would answer any useful end to give a detail of his ambiguous symptoms.

FRACTURE.

FALSE JOINTS, OR UNUNITED FRACTURES.

There is something yet to be learnt upon this subject, as to the rationale of the operation of setons, sawing off the ends of bones, &c. as means produ-

cing cure in this form of disease. I will contend, that, when a want of union exists between the broken extremities of a bone in any part of the body, owing to a deficiency in the constitution to form osseous matter; that, taking out the ends of the bone, and sawing them off; saying nothing of the formidable nature of such an operation; or *serving* the ends of the bones with caustic potash; is more calculated to confirm such *deficiency* than to renovate the constitution. I need not explain why; for a knowledge of the laws of the animal economy will answer for me. Also, how keeping up a puriform discharge for ten or twelve months, through means of a seton, from a limb under such circumstances of constitution; will lead the vessels of the broken ends of the bone to an osseous deposit, is to me inexplicable; and I will affirm, that no conclusive evidence, that it is so, can be drawn from any of the cases on record where a cure has taken place.

When means then, applied to the part, have beneficial tendency, (I intend the means hitherto made use of;) they must have influence upon some local cause preventing union. To be brief, for my limits oblige me, I will assume, that an insulated or loose splinter of bone, void of periosteum, acting as an extraneous body in the wound, is the only *local* cause which is preventing union and producing a hinge joint. Now, if we present this idea to the several recorded cures, we will find a ready explanation for the success of the different plans of treatment.

"Stephen Hammond," some three years ago, "was admitted into the New-York Hospital, with lameness, in consequence of a fracture of the leg about seven months previous. Upon examination, the tibia was found ununited, and to admit of very free motion between its ends; the fibula was entire, and the patient believed it never had been broken. From the account which he gave, it appeared he had been subjected to the proper treatment for the restoration of a broken bone, but he stated that it never showed any disposition to unite under the course which was pursued.

"As his general health was not good, he was put upon tonic medicines, and invigorating diet, and was directed a stimulating plaster of gum ammoniac and mercury should be applied over the part with the many-tailed bandage; and splints to reach above the knee and below the ankle, and to be very firmly secured; he was also advised to walk upon it with the assistance of his crutches, as much as the pain would any way permit, informing him that the object in wishing this exercise, was to inflame and irritate the ends of the bone; and that

he must not desist, even though considerable pain should accompany it. This was persevered in for several weeks, but finding little or no pain to attend it, and no appearance of inflammation in or about the fracture, and no hope of amendment, it was discontinued. Blisters were next repeatedly tried, but to no purpose. Very powerful shocks of electricity also were passed in different directions through the part, but they produced no beneficial effects.

"A seton was next introduced: this was done by making a small incision upon the outside of the tibia, down to the fractured ends, then passing between the bones the stilette of a small trocar, and pushing it out on the opposite side, the seton was readily introduced with an eyed probe.

"In a few days considerable inflammation and pain supervened, which required emollient poultices and the antiphlogistic treatment to subdue it. This was soon followed by a copious discharge of matter from the seton, and a collection of pus on the anterior part of the tibia, which was evacuated by a small incision. After five or six weeks, he became sensible of an increase of firmness in the leg, and from this time he was directed to diminish the size of the seton one thread every other day, until it was all removed. It continued to grow stronger every day, and in a short time after the wounds healed, he was permitted to walk a little upon it, when splinted and tightly bandaged, and in about three months the bone was firmly united."

"John Smith, aged forty-one years, became a patient in the hospital in 1819, in consequence of an ununited fracture of the thigh bone, of twelve months standing. It occurred at sea, and at the same time several of his ribs were fractured. Thirty-six days after the accident, he arrived at Halifax, without having had any attention paid to the adjustment of the bones. After his arrival, he states, that little notice was taken of his thigh, and no attempt was made to reduce it. He recovered without difficulty from the fracture of his ribs. The several means mentioned in the preceding case were tried, but without benefit. The limb was considerably shortened from the obliquity of the fracture and ends of the bone overlapping. No advantage attending the use of the means referred to, a seton was recommended. In the introduction of this, much more difficulty was experienced than in the case of Hammond.

"An incision was made on the inside of the thigh, a little to the outside of the artery, so as to come down upon the centre of the ends of the bones, where they overlapped. The stilette was then

attempted to be passed between the bones, but this was found altogether impracticable, from their very close contact, even though the limb was changed from one position to another. Instruments of different sizes were resorted to, but they could only be made to pass a very small distance. A *gimblet* was tried, but very little progress could be made. Having provided for the occasion a *carpenter's bit*, about the size of a large trocar, I found with this a passage could be made with the greatest facility. Then, by making an incision down to the end of the instrument, on the outside of the thigh, a large seton was readily conveyed through between the bones, by means of a long-eyed probe.

"After the expiration of three months, the thigh becoming firmer, and much less motion being felt between the ends of the fracture, he was permitted gradually to lessen the size of the seton. The firmness continued regularly to increase, but it was not until after eight months had elapsed, that the thigh had acquired sufficient firmness to enable him to support the weight of his body by the aid of a crutch.

"It is now more than twelve months since the seton was introduced, and the bone appears to be firmly united. The shortening of the limb does not exceed three inches and a half."

These were cases in which I should say, the spicula of bone had either escaped the limb by the course of the seton, was pushed out by the *carpenter's bit*, or had found its way along the muscles, at some distance from its former situation; so that it ceased to prevent union between the broken bones; or perhaps it might have been dissolved and absorbed pursuant to the inflammation, the consequence of the seton; but this last result I should be less inclined to believe.

I have observed, and I believe it is the fact, that the seton is of more doubtful success in cases of hinge joint of the humerus, than even of the femur, or either of the bones of the lower extremity; and I am satisfied with this explanation, why it is so, viz. that the patient will keep his bed, no doubt, when the seton is in the thigh or leg, by which the spicula will find a more ready escape; but, when in the upper arm, the course of the seton may not be such as to invite the spicula outwardly; especially when the patient walks about with his arm in a sling. While I was at Philadelphia, I saw a man in the Alms-house who had, I think, for three years been under a hinge joint of the humerus, and from the nature of the cause producing the fracture, I was convinced the bone had been comminuted. He had had the

seton, as I was informed, applied twice, being kept in several months each time, under the special direction of Dr. Physick himself; yet the bone was still ununited. The patient was a good-looking fellow, a young man, and acknowledged by all to have got remarkably fat while in hospital. I expressed a great desire to the attending surgeons to have the bones cut down upon, and the spicula, which I felt assured was present, removed. I do not know whether it has yet been done.

I have just met with a case of hinge joint of the humerus, by Mr. Earle, in the 12th vol. (just published) of the *Medico-Chirurgical Transactions of London*, which is not in contradiction to the opinion I hold of this disease.

"Mr. C. of Teignmouth, fell from his horse in August, 1820, and fractured his left humerus, near the insertion of the deltoid muscle. He felt very little pain at the moment of the accident, and none at all after the limb had been placed in splints. Nothing worthy of remark occurred during the early treatment of the case; but, at the usual period, on removing the splints, it was found that no union had taken place. After a lapse of some months he consulted an eminent surgeon at Exeter, who wished him to submit to an operation, with a view to excite ossific inflammation. This, however, he declined; and the following May he came up to London, and placed himself under my care. His age was about thirty, and he stated that he had generally enjoyed good health. In his infancy he had suffered from fits, which had caused a paralytic state of the right arm, which was wasted, and nearly useless. This circumstance rendered it more important to endeavour to restore the left, which had been fractured. On examining it, I found the broken ends perfectly moveable, one upon the other, and the superior portion was drawn in towards the axilla, and did not appear in close coaptation with the inferior. While I was examining him, I was surprised to find that the integuments of the arm and forearm, in the space of a few minutes, became covered with urticaria. On remarking this to him, he stated, that he had been subject to this affection for many years; that he never suffered in his health from it; and that the slightest irritation, and even the friction of his clothes, would at any time produce it. This led me to be very particular in my inquiry into the state of his general health, and his various secretions. He had an unhealthy, sallow aspect; he perspired profusely, and his perspiration had a peculiar fetid smell, and stained his linen of a brownish tint. His appetite was good, and he slept well; but his bowels were very irritable.

Fermented liquors, such as beer and cider, or any irregularity of diet, produced a copious deposit of lithate of ammonia in his urine; although he was not sensible of any dyspeptic feelings, and conceived himself in health. His common beverage was cider. I recommended him to have a seton passed through the arm, between the ends of the bone; which, on a revision of all the circumstances of the case, I was led to hope might be attended with success. I further recommended him to take the opinion of Mr. Brodie, who concurred with me in the propriety of the measure.

"On the 16th of June the operation was performed. An incision was made down to the bone, along the outer edge of the biceps, when I found that the fracture had been oblique, and that there was a projecting point occupying the outer part of the inferior portion; behind this I passed the needle, directing it through the interval between the ends of the bone. There was but little resistance to its progress. Considerable inflammation and a copious discharge of offensive matter followed; and, for some days, there was a good deal of fever and constitutional disturbance. The soft parts around the fracture became much thickened, and some hopes of union were entertained from this circumstance. After a time, however, this thickening subsided, leaving the limb quite as moveable as before the operation. The discharge became thin and ichorous, and excoriated the surrounding skin. The greatest attention was paid to maintain the ends steadily in contact, and his diet and general health were strictly regulated during the whole treatment of the case. At the end of seven weeks the seton was withdrawn, having totally failed in producing any bony deposit, though it had certainly caused considerable inflammation in the soft parts immediately around the bone. On mentioning the case to some medical friends, and considering with them the propriety of any further attempts to produce the union, Mr. Green suggested an operation which he had seen successfully practised by the late Mr. Henry Cline, which consisted of applying caustic potash to the ends of the bone. On considering the subject, the practice appeared to afford some probability of success in the present case; and the age of the patient, and the useless state of his other arm, fully warranted any attempt. The nature of the operation, and the possibility of its failure, were fairly represented to him, and on the 2d of August he submitted to the trial, on which occasion I was favoured with the assistance of Mr. Green.

"An incision, about four inches in length, was made through the integu-

ments, over the broken part; the broken ends of the bone were laid bare, and were found to be separated by a small detached portion of bone and a fibro-cartilaginous deposit. A small quantity of pus was still in the tract of the seton. The intervening substance was freely removed with a scalpel, but owing to the irregular surface of the bone it could not be entirely separated. A stick of caustic potash was then rubbed upon the ends of the bone, until the whole appeared black. I was in hopes, by thus producing artificial necrosis, to call forth into action the ossifying powers of the surrounding bone and periosteum. In performing the operation much caution was required, as the upper part of the bone lay close to the humeral artery. This rendered the operation rather more tedious, but the patient endured it with much fortitude, and afterward declared that he would rather submit to a repetition of it, than have another seton passed. Very little constitutional irritation followed, and no more inflammation in the part than was desirable. Considerable thickening took place round the bone, and the patient expressed a consciousness of returning strength and power in the limb. The sloughs of the softer parts came away in about a week, and two trifling exfoliations at the end of about six weeks. The wound granulated kindly, and was only kept from closing by the exfoliations. While there was a free discharge from the wound the disposition to urticaria ceased, but it returned as soon as the wound was healed. The thickening round the fracture had a very firm feel, and bore all the character of a callus. The consciousness of returning strength, and the increased firmness of the limb, were very encouraging, and induced Mr. Brodie, Mr. Green, and myself, to entertain very sanguine hopes of success. In the beginning of October I constructed an apparatus, calculated to give very firm and steady support to the limb, which was applied before he left town, at which time there was only a very slight degree of yielding, in one direction, towards the wound. I recommended him to be very careful, and to continue to wear the apparatus for some time. I have since had the mortification to hear from him, stating that he continued to wear the apparatus until Christmas, and on leaving it off, he found that the whole of the callus had been absorbed, and the limb was as weak and useless as before.

"On reflecting on this case, the following question suggests itself:—Did the want of union depend on any peculiarity of constitution in the individual, arising from causes over which we have no control? All the circumstances of the case seem to favour such an opinion. In the first place, although the ends of the bone

were not in very close adaptation, *and a small piece of detached bone was interposed*, the space between them was not sufficient to prevent union in a healthy person, and the separate portion of bone was not deprived of vitality. Next, although he was certainly not in a good state of health; yet, any flesh wounds which he had met with accidentally, and those which were inflicted in the operations, healed without difficulty; which proves that his vital powers were sufficiently active; of which, indeed, the state of his pulse, his time of life, and his power of enduring fatigue, afforded satisfactory evidence. It was clearly then not from debility that the bones would not unite. How far it may have been connected with the state of his skin, and digestive organs, must be determined by further experience. Another question suggests itself, which may be worth mentioning. Would it have been better to have left off the support earlier? To employ the language of Hunter, would the stimulus of necessity have called forth greater activity, which was not roused so long as the artificial support was employed?"

I hope the stimulus of necessity, or some other cogency, will soon direct to a decision in favour of a true pathology for this disease.

GONORRHOEA. In the New-York Hospital Reports, there are eight cases recorded of the use of cubebs in gonorrhœa, by Dr. Stevens. In all except one the cubebs cured the disease; in some cases in four days, in others within the month. In the case wherein it failed, it had been used for four weeks, beginning with a dessert spoonful, and ending with an ounce a day, without the least abatement of the discharge; but by having recourse to an ordinary injection, he was discharged from the hospital in four days, "nearly or entirely cured." The doctor states, that although unwilling to believe it a specific, he is unable to point out any stage of the disease in which it does not appear to be generally beneficial. In discharges from the urethra, attended with stricture, he had not occasion to try it; neither had he ventured to prescribe it during the presence of high-inflammation.

I think I shall render a service to the American student, by giving a transcript of a paper of surgeon T. D. Broughton, of the St. George's and St. James' Dispensary, London, upon the efficacy of Cubebs, or Java Pepper, just published in the 12th volume of the *Medico-Chirurgical Transactions*. He proceeds,

"The history of this plant, its nature and tendency, and the best modes of preparing and exhibiting it, being already before the public, I shall confine myself altogether to a summary account of the

results of my exhibition of Cubebs in fifty cases of gonorrhœa; the largest proportion of which were those of soldiers, and the remainder dispensary and private patients.

"The preparations employed were the powder, and the wine or tincture; the former in doses of from half a drachm to two, the latter from one drachm to half an ounce, twice or thrice a day.

"The following statement will exhibit a concise and general view of the results:

Patients cured in from two to seven days,	10
eight to fourteen,	17
fifteen to twenty-one,	18
twenty-two to thirty,	1
in fifty-five days,	1
Patients in whom no sensible effects were produced,	3
Total,	50

"In five of the above cases, though the relief obtained was immediate and decidedly marked, the final cure was completed under the use of copivy in four of them, and an astringent injection in the other.

"In one case, the complaint having been arrested, returned again, and was eventually removed by copivy.

"Two cases, solely removed by the cubebs, were attended with swelling of the testicles, and one was accompanied by severe chordees, for which the usual remedies were used, in conjunction with cubebs. A small proportion of these cases only were of the severer kind, and two such were among the failures.

"The greater part were recent cases; but one of six months' existence yielded to cubebs in as many days, while the case of fifty-five days' cure had existed no more than a fortnight.

"Among fifty cases treated with cubebs, there were, therefore, three total failures, five relieved, and one suffered a relapse; leaving forty-one cases cured under the use of the pepper, in less time than a month, with one exception; the largest proportion in less than three weeks, and several in a few days, among which latter some were well in eight-and-forty or thirty-six hours; and, the failures excepted, the relief in all cases, where the symptoms were urgent, was very sudden; and only two instances of swelling of the testicles occurred, and one of chordees continuing after the exhibition of the pepper, although in other respects the clap was relieved directly.

"The account may therefore stand thus:

Cured,	41
Relieved,	5
Cured and relapsed,	1
Failed,	3
Total,	50

"It may be said that other plans of treatment are capable of affording similar results, especially that of injecting. But there are some points of view in which I cannot avoid looking at the cubebs pepper more favourably than any other remedy. It seems to possess the power of allaying irritation beyond that of alkalies, or the nitre and gum powders, and also of diminishing the discharge. Over balsam of copivy it seems to hold an advantage, in being admissible in the earliest and worst stages of the severest gonorrhœa, without being pre-
ductive of inconvenience to the patient; while I have not found its continuance attended with that injury to the functions of the stomach which so frequently arises from full and continued doses of copivy.

"It appears to be superior to injections in not possessing any one of their injurious effects; and a remedy which is equally effective, and introduced into the general system, is, I think, more valuable than one applied topically to such a membrane as that of the urethra.

"As to the time which is usually consumed in removing a clap with cubebs, I think it might challenge most remedies in this respect, and is not more fickle in its operation. And, at the same time, we must take into consideration its negative qualities, which, rendering it a perfectly safe remedy, would naturally induce an inclination to sacrifice a little time, were it necessary, for the sake of avoiding the chances of a ruder, though a quicker plan of cure.

"Upon the whole, considering the effects in general of medicines on the human constitution, the resistance which the latter often opposes to the former, and the variable state of medicines, there are grounds for presuming that the cubebs pepper, though certainly not a specific, is as worthy of being relied upon, in removing gonorrhœa, as any other remedy, while its exhibition is unattended with any dangerous or disagreeable consequences; and it is frequently a quicker remedy in its action than those usually employed.

"As to the general use of this pepper, I agree with others in thinking, that when it does not seem to act in three or four days, it should be superseded by some other remedy; and as soon as (having relieved the urgent symptoms) it appears to cease exerting its influence on the constitution, the balsam of copaiva may be employed advantageously.

"Although no general rule can be laid down, yet it appears to me that those cases in which most benefit may be expected to arise from the use of cubebs, are the most recent, and perhaps not the severest cases; in short, those case

which are most usually met with in practice.

"As a farther advantage of this medicine, it may be added, that the habits of life and mode of diet need not to be infringed upon any further than such as common sense would dictate to every individual labouring under a local inflammatory affection, which, in every instance must be aggravated by exercise and intemperance; and recovery assisted by means of rest and abstinence, proportionate to the degree of the existing inflammation; the neglect of it would be opposed to the beneficial influence of any remedy whatsoever."

HEAD, INJURIES OF. There is a circumstance connected with the after treatment in these cases, which, if made general practice, would, I think, soon be conspicuous among remedial means in injuries of the head. I allude to a long interval between the first and second dressings, after operations, or wounds of the cranium or scalp.

I have frequently witnessed persons in low life, even bruisers and drunken people, having an extensive injury of the scalp, or even fracture of the cranium; from circumstances neglected for a week or ten days, and recover without any bad symptom. I have, even at this period, been sent for; and carefully cutting off the matted hair which covered the wound, and which was not easily removed, have dressed with adhesive plaster and a neat bandage. But by next morning, symptoms have supervened which required bleeding, and a most active antiphlogistic treatment; which I now feel assured would not have occurred, had I left the parts to themselves. I have been led to remark, moreover, that when wounds of the scalp and cranium have taken place in persons of a better standing, and who have been dressed daily from the commencement, especially if I had been joined by some formal consultants; that they have generally been troublesome to manage. Every practising surgeon, must be sensible of this fact. But how is it to be accounted for?

It does appear to me, that these parts, and especially those within the cranium, are induced to accommodate themselves to the pressure of the first dressing; and that, by it the inflammation, supervening to the injury, is moderated and regulated. But when the dressings are removed daily, there is as often a reaction in the vessels set up, under which they receive more blood for a time, which becomes a new excitant to inflammatory action. The delay between first and second dressings, after the operation of the trepan, is no doubt of decided advantage, and from this cause; by preventing an excess

of inflammation in the vessels of the pia mater.

In the 1st vol. of the *Physico-Medical Transactions of New-York*, published in 1817, we have three cases recorded by Dr. Mott, to illustrate this practice. The first was a boy of fifteen years of age, who underwent the operation of the trephine, for an extensive fracture and depression of the cranium, accompanied with a laceration of the dura mater, and a wound of the arteria meningeal media; he was dressed the *fifteenth* day after the operation, and did well without a bad symptom.

The second case I shall transcribe:

"I was requested early this morning to visit Thomas Williams, aged ten years, who had fallen from a stoop leading into the second story of a house, about fifteen feet high. He struck upon some round paving stones which covered the yard, with his side, and the side and back part of his head. When taken up he was entirely insensible, and appeared to his friends to be dead. It was about three-fourths of an hour after the accident, before I saw him. I found him lying on his side, and when an attempt was made to move him he appeared very much offended, though he did not speak. The pulse, breathing, and eyes, were all natural; and there was no vomiting.

"On the lower and middle part of the left parietal bone was a considerable tumour of the scalp, and a very small wound. The sensation to the feel around the tumour and wound, left no doubt (as far as the feel can be depended upon in these cases,) that there was a fracture, with considerable depression of the cranium. At this kind of treatment he complained a good deal, and requested to be left alone; the stupor which was first produced having now entirely gone off.

"To ascertain the state of the skull, I made an incision to the extent of about two inches, which enabled me to introduce my finger, and even see the fracture and depression.

"It became necessary in order to make the requisite divisions of the scalp, and to ascertain the extent of the depression, to request the assistance of five of the bystanders, in order to confine him.

"The depression was such, that with the elevator several pieces of bone were removed. The trephine was applied three times before all the depressed part could be elevated or removed, so as to take off all the pressure from the brain. The trephine was applied twice to the parietal bone, and once upon the os occipitis, opposite the posterior and inferior angle of the parietal bone. Eighteen pieces of bone were saved during the operation, and no doubt some of the smaller were lost. Two large pieces were ele-

vated, and appeared so firm that it was not deemed necessary to remove them. A large *crack*, (for it would admit the handle of a scalpel,) extended from the anterior part of the depressed portion, and, from the size of it, and the distance it was traced, it in all probability was continued into the left orbit.

"Another fracture, not so wide as the first, went through the squamous part of the temporal bone, and may have terminated in the petrous part of the same. It was extremely difficult to remove and elevate the injured portions of the bone, owing to the extent of the surrounding injury, and motion, as it were, of the whole side of the cranium. The fulcrum of the old cases, would have been an excellent instrument in this operation, by resting at a distance upon the sound bone.

"The dura mater under the os occipitis was lacerated about an inch in extent.

"The head having been extensively shaved, the wound of the scalp was nicely drawn together, and retained by straps of adhesive plaster. The incision in the scalp resembled an inverted T; it was easily made to coaptate, except that part which extended transversely across the temporal muscle. At this place there was a trifling retraction of the edges, notwithstanding the plasters. The hemorrhage was considerable from the necessary division of the posterior branch of the temporal artery, and a large branch, if not the trunk, of the occipital artery. Over the straps of adhesive plaster, a large quantity of soft scraped lint was applied, with a thin compress, and the whole secured by a night-cap, so as to avoid all pressure upon the brain.

"He was now conveyed to bed, the room was darkened, and all noise directed to be guarded against. When told that the operation was over, and he was to be dressed, he was pretty easily controlled. His hands were secured together to prevent him from tearing off the dressings.

"Before the operation was completed, the pupils of both eyes were considerably dilated, and almost motionless, and continued so for two days.

"The night after the operation, he was very restless, constantly tossing himself about the bed. The following morning, and occasionally during the next and succeeding days, he was affected with retching, but it did not amount to complete vomiting. He appeared to understand when spoken to, but could not articulate a word for two or three days; and when he began, it was in a low whisper, and with an awkward and clumsy motion of his tongue. Indeed it was evident that he understood before this, when spoken to, as he would an-

swer by a significant motion of his head.

"The arterial system was very little affected; his pulse, for eight or ten days after the operation, was about a hundred strokes in a minute, but not the least tense. His tongue was moist and clear, from the beginning to the end of his confinement. He did not complain of any thing but a soreness in his head, at any time, from the operation; his bowels were kept open by the daily use of an enema. His diet was of the mildest kind, consisting of gruel, barley, and toast-water: this course was rigidly observed.

"On the twelfth day from the operation, he was walking about the room, and did not complain of any thing but weakness.

"On the morning of the *sixteenth day* from the injury, I dressed the head. Every part of the wound was healed by the first intention, except about half an inch of that part which went through the temporal muscle:—here were two granulations, each about the size of half a pea, which was the only suppurating surface to be seen. It was dressed with a small pledget of simple cerate.

"The head was again dressed on the nineteenth day from the operation, when it was completely healed at every point of the incision. The faculties of his mind and the functions of his body did not appear to be in the least impaired. For the general debility, he was recommended a more generous diet, and directed to take a little cinchona daily."

"The third case was wherein the os frontis was extensively depressed, accompanied with a laceration of the dura mater in several situations. The meninges in the whole were torn to the extent of nearly two inches, from which the cerebrum was constantly discharging; and it is said, from the appearance there must have been nearly two tea-spoonsful of this substance lost. After the operation of the trephine, the wound was dressed with adhesive straps, lint, and a nightcap, in the usual way, and the patient put to bed.

"On the *sixteenth day* from the operation, the wound was dressed. It had all united by the first intention, except about half an inch in extent, which cicatrized in a few days by the use of a little argenti nitratum, to repress the exuberant granulations. He sat up in a chair, to have the first dressing removed, and had been walking about the chamber for several days previously."

The author says, "If renewing the dressings were entirely free from danger, there is another important reason why they should not be removed at this time; and particularly if a large portion of the

cranium has been taken away. The brain, by this time, has become accommodated to the pressure of the first dressing, and feels no way impatient under it; therefore, besides the irritation attendant upon the removal of the first: the pressure of the second cannot be so nicely graduated as the tender brain, at this time, so imperiously demands.

END OF THE FIRST VOLUME.



